



INDIAN AGRICULTURAL
RESEARCH INSTITUTE, NEW DELHI.

I. A. R. I. 6.

MGIPC—SI—6 AR/54—7-7-54—10,000.

SMITHSONIAN INSTITUTION
UNITED STATES NATIONAL MUSEUM

PROCEEDINGS

OF THE

UNITED STATES NATIONAL MUSEUM

VOLUME 89



UNITED STATES
GOVERNMENT PRINTING OFFICE
WASHINGTON : 1942

ADVERTISEMENT

The scientific publications of the National Museum include two series, known, respectively, as *Proceedings* and *Bulletin*.

The *Proceedings* series, begun in 1878, is intended primarily as a medium for the publication of original papers, based on the collections of the National Museum, that set forth newly acquired facts in biology, anthropology, and geology, with descriptions of new forms and revisions of limited groups. Copies of each paper, in pamphlet form, are distributed as published to libraries and scientific organizations and to specialists and others interested in the different subjects. The dates at which these separate papers are published are recorded in the table of contents of each of the volumes.

The present volume is the eighty-ninth of this series.

The series of *Bulletins*, the first of which was issued in 1875, contains separate publications comprising monographs of large zoological groups and other general systematic treatises (occasionally in several volumes), faunal works, reports of expeditions, catalogs of type specimens, special collections, and other material of similar nature. The majority of the volumes are octavo in size, but a quarto size has been adopted in a few instances in which large plates were regarded as indispensable. In the *Bulletin* series appear volumes under the heading *Contributions from the United States National Herbarium*, in octavo form, published by the National Museum since 1902, which contain papers relating to the botanical collections of the Museum.

ALEXANDER WETMORE,
Assistant Secretary, Smithsonian Institution.

CONTENTS

	Page
BARTSCH, PAUL. The West American <i>Haliotis</i> . No. 3094. August 15, 1940 ¹ -----	49-58
New species: <i>Haliotis sorenseni</i> , <i>H. aulaea</i> , <i>H. smithsoni</i> .	
New subspecies: <i>Haliotis rufescens hattorii</i> .	
BARTSCH, PAUL. See under Torre, Carlos de la-----	131-385
BASSLER, R. S. A supposed jellyfish from the pre-Cambrian of the Grand Canyon. No. 3104. February 27, 1941 ¹ ---	519-522
New species: <i>Brooksella canyonensis</i> .	
CHAPIN, EDWARD A. A revision of the West Indian beetles of the scarabaeid subfamily Aphodiinae. No. 3092. May 23, 1940 ¹ -----	1-41
New species: <i>Suprosites blackwelderi</i> , <i>Atacnius beattyi</i> , <i>A. abdi-</i> <i>toides</i> , <i>A. corrosus</i> , <i>A. subopacus</i> , <i>A. edwardsi</i> , <i>A. insulicola</i> , <i>A. jamaicensis</i> , <i>A. luteomargo</i> , <i>A. brevinotus</i> , <i>Euparixia bruneri</i> .	
CLARK, AUSTIN H. Echinoderms from Greenland collected by Capt. Robert A. Bartlett. No. 3098. February 27, 1941 ¹ -----	425-433
New species: <i>Leptasterias (Hexasterias) bartletti</i> .	
CLARK, HUBERT LYMAN. A revision of the keyhole urchins (<i>Mellita</i>). No. 3099. December 12, 1940 ¹ -----	435-444
New species: <i>Mellita lata</i> , <i>M. latiambulacra</i> .	
New variety: <i>Mellita quinquesperforata tenuis</i> .	
HOBBS, HORTON H., Jr. Seven new crayfishes of the genus <i>Cambarus</i> from Florida, with notes on other species. No. 3097. November 23, 1940 ¹ -----	387-423
New species: <i>Cambarus pallidus</i> , <i>C. hubbelli</i> , <i>C. kilbyi</i> , <i>C. rath-</i> <i>bunae</i> , <i>C. pictus</i> .	
New species and subspecies: <i>Cambarus lucifugus lucifugus</i> , <i>C. l.</i> <i>alachua</i> .	
HYMAN, LIBBIE H. The polyclad flatworms of the Atlantic coast of the United States and Canada. No. 3101. Febru- ary 27, 1941 ¹ -----	449-495
New genera: <i>Digynopora</i> , <i>Planctoplanella</i> , <i>Coronadena</i> .	
New species: <i>Stylochus pulcher</i> , <i>Euplana carolinensis</i> , <i>Digynopora</i> <i>americana</i> , <i>Planctoplanella atlantica</i> , <i>Acerotisa baiac</i> .	
New combinations: <i>Coronadena mutabilis</i> (Verrill, 1873), <i>Disco-</i> <i>celides ellipsoides</i> (Girard, 1854), <i>Latocestus whartoni</i> (Pearse, 1938), <i>Hoploplana inquilina thaisana</i> (Pearse, 1938), <i>Gnecioceros</i> <i>floridana</i> (Pearse, 1938), <i>Enantia pellucida</i> (Pearse, 1938).	

¹ Date of publication.

- KIRK, EDWIN. *Dinotocrinus*, a new fossil inadunate crinoid genus. No. 3103. February 28, 1941¹----- 513-517

New genus: *Dinotocrinus*.

New species: *Dinotocrinus compactus*,

New combinations: *Dinotocrinus roemeri* (Troost), *D. salteri* (Worthen).

- SAYLOR, LAWRENCE W. Revision of the scarabaeid beetles of the phyllophagan subgenus *Listrochelus* of the United States, with discussion of related subgenera. No. 3095. November 15, 1940¹----- 59-130

New species: *Phyllophaga* (*Listrochelus*) *mirafloza*, P. (L.) *mich-
elbacheri*, P. (L.) *pcninsularis*, P. (L.) *huachuca*, P. (L.) *chapini*, P. (L.) *granti*, P. (L.) *reinhardi*, P. (L.) *kochleriana*,
P. (L.) *neomexicana*, P. (L.) *meadei*, P. (L.) *cochisa*, P. (L.) *texensis*, P. (L.) *wickhami*, P. (L.) *cushmani*, P. (L.) *mac-
murryi*, P. (L.) *arizona*, P. (L.) *snowi*.

New names: *Phyllophaga* (*Listrochelus*) *pilosipes*, P. (L.) *tro-
chanter*.

- SCHAUS, WILLIAM. New species of heterocerous moths in the United States National Museum. No. 3102. March 6, 1941¹----- 497-511

New species: *Protoparce maricina*, P. *huascara*, *Xylophanes cantel*,
Rothschildia mussehl, R. *bucaya*, *Automeris hosmera*, *Hallsidota*
zacualpana, H. *biedala*, H. *terola*, H. *louella*, H. *loisona*, H. *dul-
tona*, H. *ishima*, H. *austina*, H. *soldina*, H. *jossa*, H. *azadina*,
H. *quascana*, H. *cloisa*, H. *grota*, H. *nayapana*, H. *toledana*, H.
alarica, H. *martona*, H. *calvona*, H. *lomara*, H. *misona*, H. *man-
ada*, H. *siegruna*, H. *domara*, H. *suavina*, H. *potamia*, H. *sporina*,
H. *chesteria*.

- TAYLOR, EDWARD H. Two new anuran amphibians from Mexico. No. 3093. August 13, 1940¹----- 43-47

New species: *Syrrophus smithi*, *Hyla dendroscorta*.

- TORRE, CARLOS DE LA, and PAUL BARTSCH. The Cuban operculate land mollusks of the family Annulariidae, exclusive of the subfamily Chondropominae. No. 3096. April 2, 1941¹----- 131-385

New genera: *Opisthocoeleum*, *Dallsiphona*, *Xenopomoides*, *Lima-
dorex*, *Limadora*.

New subgenera: *Opisthocoelex*, *Opisthocoelops*, *Opisthocoeleum*,
Solutapex, *Mirisiphon*, *Bermudezsiphona*, *Cubitasiphona*, *Cylindro-
siphona*, *Cubadamsiella*, *Eutudorex*, *Gundlachtudora*, *Aguayotu-
dora*, *Wrighttudora*, *Tudorina*, *Annularodisca*, *Annularisca*, *An-
nularodella*, *Fossularia*, *Juannularia*, *Guajaibona*, *Subannularia*,
Annularex, *Bermudezia*, *Lugarenia*.

New species: *Opisthocoeleum* (*Opisthocoelex*) *simulans*, O. (*Opisthocoeleum*) *opisthocoele*, *Torrella* (*Torrellisca*) *trinida-
densis*, *Rhytidopoma occidentale*, R. *pinense*, R. *hespericum*,
Opisthosiphon (*Bermudezsiphona*) *cucullatum*, O. (B.) *palmeri*,

¹ Date of publication.

- O. (B.) greenfieldi*, *O. (B.) lamellosum*, *O. (B.) plateroense*,
O. (B.) prominulum, *O. (B.) insulanum*, *O. (B.) caguanense*,
O. (B.) subobtectum, *O. (B.) bermudezi*, *O. (Opisthosiphona)*
plicatum, *O. (O.) turiguanense*, *O. (Cubitasiphona) poeyi*,
O. (C.) claudens, *O. (C.) guanajaense*, *O. (C.) quinti*, *O. (C.)*
manatiense, *O. (C.) sanchezi*, *O. (C.) sosai*, *O. (C.) litorale*,
O. (C.) deviatum, *O. (Cylindrosiphona) bacillum*, *Xenopomoides*
delicatulum, *Xenopoma aguayoi*, *X. hendersoni*, *X. spinosissimum*,
Adamsiella (Cubadamsiella) gratiosa, *A. (C.) leoni*, *Limadorea*
limonensis, *Limadora scabrata*, *Tudora (Eutudorea) welchi*, *T.*
(E.) rocai, *T. (E.) complanata*, *T. (Ramsdenia) notata*, *T. (R.)*
natensoni, *T. (Aguayotudora) suavis*, *T. (A.) cristata*, *T. (A.)*
crassiuscula, *T. (A.) bermudezi*, *T. (A.) asperata*, *T. (A.)*
tuberculata, *T. (A.) aguayoi*, *T. (A.) varicosa*, *T. (A.) obsca*,
T. (Wrightudora) arcticoronata, *T. (W.) gundlachi*, *Annularia*
(Annularodes) canoensis, *A. (A.) terneroensis*, *A. (A.) cantaril-*
lensis, *A. (A.) obsoleta*, *A. (A.) perezi*, *A. (Annularops) atten-*
uata, *A. (A.) plicata*, *A. (A.) perplexa*, *A. (Annularodella)*
morenoi, *A. (Eutudora) cabrerai*, *A. (E.) transitoria*, *A. (E.)*
latistoma, *A. (Fossularia) boqueronensis*, *A. (Eutudoriscia) camo-*
ensis, *A. (Diplopoma) ramsdani*, *A. (D.) pilsbryi*, *A. (D.) son-*
goensis, *A. (D.) obsoleta*, *A. (Troschelvindeæ) barbouri*, *A.*
(T.) rocai, *A. (Blasospira) rocai*, *A. (Annularisca) aberrans*,
A. (A.) pallens, *A. (A.) tacerensis*, *A. (Annulæx) intercis*, *A.*
(A.) incerta, *A. (Bermudezia) bermudezi*, *A. (B.) payroli*, *A.*
(B.) oblitterata, *A. (B.) capestanyi*, *A. (B.) euglypta*, *A. (Lugar-*
eria) eurystoma, *A. (L.) biayensis*, *A. (L.) najacensis*, *A. (L.)*
lirata, *A. (L.) sifontesi*, *A. (Annularella) hendersoni*, *A. (A.)*
victoris, *A. (A.) arquesi*, *A. (A.) holguinensis*, *A. (A.) yumuri-*
ensis, *A. (A.) nipensis*, *A. (A.) tanamensis*, *A. (A.) libanoensis*,
A. (A.) natensoni, *A. (A.) toroensis*, *A. (A.) wrighti*, *A. (A.)*
mayariensis, *A. (Chondropomatus) mimetica*.
- New subspecies: *Opisthocoele* (*Opisthocoelex*) *paradoxum* gib-
bosum, *O. (O.) p. magnum*, *O. (Opisthocoele) lamellicostatum*
opisthocoele, *Torella (Torella) immersa camaronsensis*, *T. (T.) i.*
grillensis, *T. (Torrellisca) simpsoni terneroensis*, *Rhytidopoma*
honestum itinerans, *R. nodulatum palenquense*, *R. n. anafense*,
R. wrightianum ottonis, *R. w. cabrasense*, *R. pinense rosarioense*,
R. p. colombense, *R. p. ergastulum*, *R. p. pinense*, *R. clathratum*
candelaense, *R. c. jumaguaense*, *Opisthosiphon (Bermudezi-*
siphona) palmeri palmeri, *O. (B.) p. camajanense*, *O. (B.) lamel-*
losum lamellosum, *O. (B.) l. lowei*, *O. (B.) banoense trinchera-*
sense, *O. (B.) obturatum sulcosum*, *O. (B.) obtectum scibabocense*,
O. (B.) o. guayosense, *O. (B.) insulanum scopulorum*, *O. (B.) t.*
insulanum, *O. (B.) subobturatum tinajaense*, *O. (B.) subobtec-*
tum subobtectum, *O. (B.) s. puntillense*, *O. (B.) s. guajabanense*,
O. (B.) s. quintanense, *O. (B.) detectum murinum*, *O. (B.) d.*
lucasense, *O. (Opisthosiphona) pupoides pupoides*, *O. (O.) p.*
velazquezii, *O. (O.) p. bibijaguaense*, *O. (O.) moreletianum colum-*
bense, *O. (Cubitasiphona) berryi viguense*, *O. (C.) paredonense*
escalerense, *O. (Cylindrosiphona) bacillum garciai*, *O. (C.) b.*
bacillum, *Rhytidothyra bilabiata rosea*, *R. b. rosea*, *R. b.*
aurantiaca, *R. b. nana*, *R. b. straminea*, *Parachondria (Parachon-*
dria) texta portillensis, *P. (Parachondrops) erecta mayensis*,

P. (P.) e. ramonensis, *P. (P.) e. turquiniensis*, *P. (P.) chordata tanamensis*, *P. (P.) c. baracoensis*, *P. (P.) c. mayariensis*, *P. (P.) o. songoensis*, *P. (P.) c. Guantanamoensis*, *Limadora garciana silaensis*, *Tudora (Eutodorex) undosa laureani*, *T. (E.) u. darroi*, *T. (E.) troscheli azucarensis*, *T. (E.) t. antoniensis*, *T. (E.) t. palmaritensis*, *T. (Ramsdenia) nobilitata mirandensis*, *T. (R.) n. yaterasensis*, *T. (R.) n. mayariensis*, *T. (R.) natensoni natensoni*, *T. (R.) n. canetensis*, *T. (Agayotudora) cristata cristata*, *T. (A.) c. chorrillensis*, *T. (A.) bermudezi bermudezi*, *T. (A.) b. sibanicuensis*, *T. (A.) recta martiensis*, *T. (A.) r. barreti*, *T. (A.) aguayoi aguayoi*, *T. (A.) a. guaicanamarensis*, *T. (A.) a. najazaensis*, *T. (Wrightudora) garridoiana baracoensis*, *Annularia (Annularodes) terneroensis indioensis*, *A. (A.) t. terneroensis*, *A. (A.) perezi perezi*, *A. (A.) p. guitarti*, *A. (Annularops) sauvallei cortinai*, *A. (A.) s. chorrerensis*, *A. (A.) s. natensoni*, *A. (A.) semicana organicola*, *A. (A.) s. nana*, *A. (A.) attenuata minaensis*, *A. (A.) a. morsei*, *A. (A.) a. attenuata*, *A. (A.) blaini cumbrensis*, *A. (A.) tryoni vinalensis*, *A. (Eutudora) transitoria transitoria*, *A. (E.) t. distincta*, *A. (Eutudorisca) catenata blanesi*, *A. (Diplopoma) architectonica libanoensis*, *A. (D.) a. tanamensis*, *A. (Juannularia) arguta insularis*, *A. (Annularita) majuscula narcisi*, *A. (A.) m. cumbrensis*, *A. (A.) m. crassilabris*, *A. (A.) m. excelsa*, *A. (A.) m. catalinensis*, *A. (Troschelvindex) jiguanensis negroensis*, *A. (T.) j. bairensis*, *A. (T.) cundcuna fallax*, *A. (T.) arangiana cautoensis*, *A. (T.) a. magistra*, *A. (Blaesospira) echinus lucifer*, *A. (B.) e. infernalis*, *A. (Subannularia) storchi nipensis*, *A. (Lugarenia) eurytoma eurytoma*, *A. (L.) e. chorrillensis*, *A. (L.) najazaensis najazaensis*, *A. (L.) n. palomarensis*, *A. (L.) lirata lirata*, *A. (L.) l. parva*, *A. (Annularosa) fragilis juliani*, *A. (Annularella) mayariensis welchi*, *A. (A.) m. mayariensis*, *A. (A.) m. canapuensis*.

- WETMORE, ALEXANDER. Notes on birds of the Guatemalan highlands. No. 3105. March 26, 1941¹----- 523-581
- ZIMMERMAN, ELWOOD C. *Eurhoptodes*, a remarkable new genus of Philippine cryptorhynchine weevils. No. 3100. November 1, 1940¹----- 445-448

New genus: *Eurhoptodes*.

New species: *Eurhoptodes cratatus*,

¹ Date of publication.

ILLUSTRATIONS

PLATES

	Following page
1. <i>Syrrhopus smithi</i> , new species.....	40
2, 3. <i>Hyla dendroscarta</i> , new species.....	46
6. <i>Haliotis sorenseni</i> , new species.....	58
7. <i>Haliotis ponderosa</i> C. B. Adams.....	58
8. New species and subspecies of <i>Haliotis</i>	58
9. Species and subspecies of <i>Opisthocoeleum</i>	385
10. Species and subspecies of <i>Torrella</i> and <i>Rhytidopoma</i>	385
11. Species and subspecies of <i>Rhytidopoma</i> and <i>Opisthosiphon</i>	385
12. Species and subspecies of <i>Opisthosiphon</i>	385
13, 14. Species and subspecies of <i>Opisthosiphon</i> (<i>Bermudezsiphona</i>).....	385
15. Species and subspecies of <i>Opisthosiphon</i>	385
16, 17. Species and subspecies of <i>Opisthosiphon</i> (<i>Cubitasiphona</i>).....	385
18. Subspecies of <i>Rhytidothyra bilabiata</i>	385
19. Species and subspecies of <i>Xenopomoides</i> , <i>Xenopoma</i> , <i>Opisthosiphon</i> , and <i>Dallsiphona</i>	385
20, 21. Species and subspecies of <i>Parachondria</i> and <i>Adamastella</i>	385
22. Species and subspecies of <i>Limadora</i> , <i>Limadorex</i> , and <i>Tudora</i>	385
23. Species and subspecies of <i>Tudora</i> (<i>Eutudorex</i>).....	385
24. Species and subspecies of <i>Tudora</i>	385
25. Species and subspecies of <i>Tudora</i> (<i>Ramsdenia</i>).....	385
26. Species and subspecies of <i>Tudora</i> (<i>Aguayotudora</i>).....	385
27. Species and subspecies of <i>Tudora</i>	385
28, 29. Species and subspecies of <i>Tudora</i> and <i>Annularia</i>	385
30. Species and subspecies of <i>Annularia</i> (<i>Annularops</i>).....	385
31. <i>Annularia</i> (<i>Annularops</i>) <i>semicana semicana</i>	385
32. Species and subspecies of <i>Annularia</i> (<i>Annularops</i>).....	385
33, 34. Species and subspecies of <i>Annularia</i>	385
35. Species and subspecies of <i>Annularia</i> (<i>Diplopoma</i>).....	385
36. Subspecies of <i>Annularia</i> (<i>Annularita</i>) <i>majuscula</i>	385
37. Species and subspecies of <i>Annularia</i>	385
38. Species and subspecies of <i>Annularia</i> (<i>Troschelvindeæ</i>).....	385
39. Species and subspecies of <i>Annularia</i>	385
40, 41. Species of <i>Annularia</i> (<i>Annularisca</i>).....	385
42. Subspecies of <i>Annularia</i> (<i>Annularisca</i>) <i>auricoma</i>	385
43. Species of <i>Annularia</i> (<i>Annularisca</i>).....	385
44, 45. Species of <i>Annularia</i> (<i>Annularæx</i>).....	385
46. Species of <i>Annularia</i> (<i>Bermudezia</i>).....	385
47. Species and subspecies of <i>Annularia</i> (<i>Lugarenia</i>).....	385
48. Subspecies of <i>Annularia</i> (<i>Annularosa</i>) <i>fragilis</i>	385
49-55. Species of <i>Annularia</i> (<i>Annularella</i>).....	385
56. Subspecies of <i>Annularia</i> (<i>Annularella</i>) <i>mayariensis</i>	385
57. Species and subspecies of <i>Annularia</i>	385
58. <i>Crossaster squamatus</i> (Döderlein).....	433
59. <i>Leptasterias</i> (<i>Hexasterias</i>) <i>bartletti</i> , new species.....	433

	Following page
60, 61. <i>Mellita lata</i> , new species; <i>M. quinquiesperforata tenuis</i> , new variety-----	444
62. <i>Mellita lata</i> , new species; <i>M. latambulacra</i> , new species-----	444
63. <i>Dinotocrinus compactus</i> , new genus and species-----	517
64. <i>Brooksella canyonensis</i> , new species-----	520

TEXT FIGURES

	Page
1. Male specimen of <i>Phyllophaga (Listrochelus) disparilis</i> (Horn)-----	118
2. Abdomen and claw (male) of <i>Phyllophaga (Listrochelus) tarsalis</i> , <i>P. (L.) senex</i> , <i>P. (L.) falsa</i> , <i>P. (L.) scoparia</i> , <i>P. (L.) trochanter</i> , <i>P. (L.) flavipennis</i> , <i>P. (L.) wickhami</i> , and <i>P. (L.) neomexicana</i> -----	119
3. Genitalia, antennae, and tarsi of <i>Phyllophaga (Listrochelus) timida</i> , <i>P. (L.) snowi</i> , <i>P. (L.) scoparia</i> , <i>P. (L.) peninsularis</i> , <i>P. (L.) macmurryi</i> , <i>P. (L.) opacicollis</i> , <i>P. (L.) fimbripes</i> , <i>P. (L.) tarsalis</i> , and <i>P. (L.) kochleriana</i> -----	120
4. Anatomical views of <i>Phyllophaga (Listrochelus) trochanter</i> , <i>P. (L.) scoparia</i> , <i>P. (L.) meadi</i> , <i>P. (L.) tarsalis</i> , <i>P. (L.) falsa</i> , <i>P. (L.) granti</i> , and <i>P. (L.) neomexicana</i> -----	121
5. Abdomen and male genitalia of <i>Phyllophaga (Listrochelus) carminator</i> , <i>P. (L.) granti</i> , <i>P. (L.) densicollis</i> , <i>P. (L.) michelbacheri</i> , <i>P. (L.) miraflores</i> -----	122
6. Male genitalia of <i>Phyllophaga (Listrochelus) disparilis</i> , <i>P. (L.) arizona</i> , <i>P. (L.) duncani</i> , <i>P. (L.) cushmani</i> , and <i>P. (L.) scuticeps</i> -----	123
7. Male genitalia of <i>Phyllophaga (Listrochelus) huachuca</i> , <i>P. (L.) scoparia</i> and <i>P. (L.) chapini</i> -----	124
8. Male anatomy of <i>Phyllophaga (Listrochelus) reinhardi</i> , <i>P. (L.) mucorea</i> , <i>P. (L.) pulcher</i> , and <i>P. (L.) plena</i> ; pygidium of female of <i>P. (L.) disparilis</i> , <i>P. (L.) huachuca</i> and <i>P. (L.) chapini</i> -----	125
9. Male genitalia of <i>Phyllophaga (Listrochelus) falsa</i> , <i>P. (L.) trochanter</i> , <i>P. (L.) tarsalis</i> , and <i>P. (L.) fimbripes</i> -----	126
10. Male genitalia of <i>Phyllophaga (Listrochelus) flavipennis</i> , <i>P. (L.) granti</i> , <i>P. (L.) wickhami</i> , <i>P. (L.) macmurryi</i> , and <i>P. (L.) texensis</i> -----	127
11. Male genitalia of <i>Phyllophaga (Listrochelus) kochleriana</i> , <i>P. (L.) neomexicana</i> , <i>P. (L.) opacicollis</i> , <i>P. (L.) pilosipes</i> , and <i>P. (L.) parilis</i> -----	128
12. Male genitalia of <i>Phyllophaga (Listrochelus) cochisea</i> , <i>P. (L.) cavata</i> , <i>P. (L.) micros</i> and <i>P. (L.) meadi</i> -----	129
13. Genitalia of <i>Phyllophaga (Listrochelus) michelbacheri</i> , <i>P. (L.) densicollis</i> , <i>P. (L.) miraflores</i> , <i>P. (L.) carminator</i> , <i>P. (L.) huachuca</i> and <i>P. (L.) granti</i> -----	130
14. First pleopod of male crayfish to illustrate terminology-----	388
15. Male anatomy of <i>Cambarus acherontis</i> Lönnberg-----	391
16. Male anatomy of <i>Cambarus pallidus</i> , new species-----	395
17. Male anatomy of <i>Cambarus lucifugus lucifugus</i> , new species and subspecies-----	399
18. Male anatomy of <i>Cambarus lucifugus alachua</i> , new subspecies-----	403
19. Male anatomy of <i>Cambarus hubbelli</i> , new species-----	407
20. Male anatomy of <i>Cambarus kilbyi</i> , new species-----	411
21. Male anatomy of <i>Cambarus rathbunae</i> , new species-----	415
22. Male anatomy of <i>Cambarus pictus</i> , new species-----	421
23. <i>Eurhoptodes cratatus</i> , new species: Dorsal aspect, venter, tarsus, tibia, and side view-----	447

	Page
24. <i>Coronadena mutabilis</i> (Verrill) and <i>Discocelides ellipsoides</i> (Girard) -	451
25. Copulatory complex of <i>Discocelides ellipsoides</i> (Girard) and <i>Latocestus whartoni</i> (Pearse), and eye arrangement of <i>Stylochus ellipticus</i> (Girard) -----	455
26. <i>Stylochus pulcher</i> , new species, with copulatory complex -----	463
27. <i>Stylochus oculiferus</i> (Girard) -----	465
28. Copulatory apparatus of <i>Stylochus oculiferus</i> (Girard) and eyes and copulatory complex of <i>Euplana carolinensis</i> , new species -----	471
29. <i>Digynopora americana</i> , new genus and species, showing eyes and copulatory organs; copulatory complex of <i>Planctoplanella atlantica</i> , new genus and species -----	474
30. <i>Planctoplanella atlantica</i> , new genus and species, showing eyes and copulatory complex -----	480
31. Eyes of <i>Enantia pellucida</i> (Pearse), copulatory complex of <i>E. pellucida</i> , <i>Oligoclado floridanus</i> , <i>Acerotisa baiae</i> , new species -----	483



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3092

A REVISION OF THE WEST INDIAN BEETLES OF THE SCARABAEID SUBFAMILY APHODIINAE

By EDWARD A. CHAPIN

THE Aphodiinae form a compact group in the lamellicorn Coleoptera that is considered by some workers to be of family rank. The species have a characteristic habitus and are mostly scavengers in the dung of higher animals. Some are associated with ant colonies, and a few, notably the species of *Saprosites*, appear to feed on the dung of wood-boring insects such as the Passalidae. As a group their distribution is world wide, and the range of some species has come, through the agency of commerce, to coincide with that of the whole. This transfer of species is going on actively at present, and it is only a matter of time before the distribution of the species feeding on dung of domesticated animals will be determined not by natural barriers but by the penetration of human commerce and the adaptability of the species to new climatic conditions. To judge from the fact that *Aphodius lividus* (Olivier) is now generally established from Northern United States to the South Sea Islands and completely around the world in the Tropics and Subtropics, climate will play a minor role among the distributional factors.

There has been active commercial intercourse among the various West Indian Islands and among the islands and many localities on the mainland of the New World for about 300 years. *Aphodius sallei* Harold appears to have been introduced onto certain islands during this period. On the other hand, its distribution at present could be offered as a perfect example to support the land-bridge hypothesis, for it is abundant in Mexico and Central America, common on Jamaica, and frequent on Hispaniola, but apparently absent elsewhere. There-

fore it could be cited as a late migrant coming from Honduras across Jamaica to Hispaniola but too late to continue its way to Cuba.

The classification set forth in this paper is in general along conventional lines. One new taxonomic character, which appears to be of some importance, has been introduced. This relates to the structure of the pygidial segment of the abdomen. In the genus *Aphodius* it will be noticed that the pygidium is more or less uniformly sclerotized from base to apex, with no transverse ridge or carina and without a median longitudinal groove on the basal portion. As a corollary, the apical angles of the elytra are individually rounded, not capable of close approximation and without globular thickenings on the under sides at the angles. In the other genera of the West Indian fauna there is a curious device present that serves to lock the elytra and abdomen together. The pygidium is divided into basal and apical parts, these usually separated by transverse ridge or carina. On the basal part there is a median longitudinal groove of greater or lesser degree of development. The elytra are so constructed that when closed the apical angles are together, and they are so held by virtue of the tongue and groove construction of the sutural edges of the elytra. The apical angles are swollen beneath to form a hemispherical knob that is applied to and slides in the groove on the basal part of the pygidium. In some species the transverse carina of the pygidium is somewhat undercut to accommodate the apical edges of the elytra. This condition is found in many other genera of the Scarabaeidae, as *Choeridium* and *Phanaeus*. It is therefore a secondary modification that has arisen independently in the various groups. But within the Aphodiinae it would appear to be of some value as an indication of the close relation existing between certain tribes. Thus the Aphodiinae and Corythoderini seem to be mutually allied and to a degree separated from the Euparini, Psammodiini, and Rhyparini.

This revision is the result of a study of more than 6,000 specimens from 20 of the West Indian Islands. The greater part of this material was secured during the years 1935 to 1937 by Dr. and Mrs. R. E. Blackwelder, while Dr. Blackwelder was the holder of the Walter Rathbone Bacon Scholarship of the Smithsonian Institution. To their collections have been added the specimens already in the United States National Museum, smaller lots from St. Croix submitted by H. A. Beatty, from Puerto Rico, collected by the late Stuart T. Danforth, and a fair collection from Jamaica made by the writer in 1937 while associated with Dr. and Mrs. Blackwelder. This probably is a greater mass of material than has been available to any previous worker. Thanks are offered to these and others, notably to G. J. Arrow, of the British Museum, for loan of specimens; to H. E. Hin-

ton, also of the British Museum, for material from his collection and suggestions; and to Dr. P. J. Darlington, of the Museum of Comparative Zoology, for the loan of considerable material from the Greater Antilles.

TABLE 1.—*Distribution of West Indian Aphodiinae*

Island	Aphodius			Pleuraphorus parvulus	Psammodius bidens	Sap- ro- sites	Ataenius																													
	cuniculus	lividus	sallei				quadridentatus	grenadensis	blackwelderi	baroldi	steinheili	beatvri	abditoides	vincentiae	corrosus	abditus	imbricatus	miami	tenebrosus	frater	strigicauda	gracilis	cribrithorax	darlingtoni	hogaster	jamaicensis	subopacus	elongatus	sulcatus	edwardsi	aculeus	versicolor	insulicola	luteomargo	terminalis	brevinotus
Cuba.....	x	x		x			x					x						x	x	x	x	x	x				x									
Jamaica.....	x	x		x					x					x				x	x	x	x	x	x													
Hispaniola.....	x	x	x	x																																
Puerto Rico.....	x	x			x																															
Vieques.....	x	x																																		
St. Thomas.....	x	x								x																										
St. John.....	x	x																																		
Tortola.....																																				
St. Croix.....	x	x			x					x																										
St. Kitts.....	x	x																																		
Antigua.....	x	x																																		
Montserrat.....	x	x																																		
Guadeloupe.....	x	x																																		
Dominica.....	x	x			x																															
Martinique.....	x																																			
St. Lucia.....	x																																			
Barbados.....	x									x																										
St. Vincent.....	x				x						x	x																								
Carriacou.....	x																																			
Grenada.....	x	x			x	x		x																												

KEY TO WEST INDIAN GENERA OF APHODIINAE

1. Pygidium without sharp division into basal and apical parts, apical angles of elytra not thickened..... **Aphodius**
- Pygidium divided into two parts by a more or less distinct transverse carina; basal part furnished with a median longitudinal groove; apical angles of elytra thickened to conform to groove on pygidium..... 2
2. Middle coxa long and oblique, terminating beneath edge of elytral epipleurum..... **Euparixia**
- Middle coxa oval, not touched by elytral epipleurum, prothorax not strongly constricted basally..... 3
3. First segment of hind tarsus as long or nearly as long as three following combined..... 4
- First segment of hind tarsus about as long as two following combined..... 5
4. Front of head coarsely granulate; first segment of hind tarsus triangular; longer spur of hind tibia broad and as long as first three tarsal segments combined..... **Psammodius**.

- Front of head at most rugose; first segment of hind tarsus slender; longer spur of hind tibia about as long as first tarsal segment..... **Ataenius**
5. Elytra margined across base by a carina, which is broken by each stria; humus-dwelling species, often taken on wing at dusk.. **Pleurophorus**
- Elytra not margined across base; species living in dead wood associated with other insects..... **Saprosites**

Genus APHODIUS Illiger, 1798

Aphodius ILLIGER, 1798, Verzeichniss der Käfer Preussens, p. 15.—CURTIS, 1824, British entomology, vol. 1, No. 27.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodiinae, p. 8.

Type of genus: *Scarabaeus fossor* Linnaeus (by subsequent designation of Curtis, 1824).

The genus *Aphodius* was established in 1798 to include 32 species, but without any designation of type species. Curtis, in 1824, selected one of these as type of the genus, choosing the largest of the included species. His action is entirely in accord with the International Rules and must stand. The type designations *Scarabaeus oblongus* Scopoli by Gozis, 1886, and *Scarabaeus erraticus* Linnaeus by Paulian, 1935, are both invalid.

Almost four-fifths of the roughly 700 species of this genus are from the Old World and about half of all the species are Palaearctic in origin. They feed on the excrements of the higher animals.

KEY TO WEST INDIAN SPECIES OF APHODIUS

1. Anterior margin of clypeus with 4 acute teeth, median pair longer than external; Cuba..... 1. *quadridentatus* Harold
- Anterior margin of clypeus without acute teeth..... 2
2. Pronotum with a fine but distinct basal margin, surface rather coarsely and densely punctured; elytral striae deep; form robust, length 4-5 mm..... 2. *sallei* Harold
- Pronotum without basal margin, surface sparsely punctured, shining..... 3
3. Pale brown with pronotal disk, elytral suture and disks darker; pronotal punctures mostly fine with a few coarse ones at sides. 3. *lividus* Olivier
- Piceous with sides of pronotum and elytra and legs slightly paler; pronotal punctures coarse but sparse..... 4. *cuniculus* Chevrolat

1. APHODIUS QUADRIDENTATUS Harold

Aphodius quadridentatus HAROLD, 1861, Berlin. Ent. Zeltschr., vol. 5, p. 107; 1863, loc. cit., vol. 7, p. 331.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodiinae, p. 157.

Subconvex, shining, rufopiceous, with sides of pronotum, apices of elytra, and a few small spots on elytra reddish yellow. Head flat, with a low weak swelling at middle, finely punctured, gena angulate and prominent; clypeus anteriorly subtruncate, on each side with the angles produced as small teeth; within these teeth a second pair of

sharper, larger, and forwardly directed teeth, behind which on the clypeus are the two small approximate tubercles. Pronotum somewhat convex, with rounded posterior angles, finely margined at base, rather thickly punctured, the punctures of two sizes mixed. Scutellum elongate oval, free of punctures. Elytra a little widened at middle, at base as wide as pronotum, striae strong, intervals elevated and almost keeled, shining, not distinctly punctured, the outer intervals beginning with the sixth, grooved; rufopiceous with humeri, lateral margins, apices, and a few small flecks on disk and at base reddish yellow. Antennae, palpi, and legs reddish yellow, first segment of hind tarsus as long as the three following taken together. Length: $2\frac{3}{4}$ –3 lines (5.5–6 mm.).

Type.—Possibly in collection of R. Oberthuer, Rennes.

Type locality.—Cuba.

Material examined.—Apparently no additional specimens of this species have been seen since the original lot. If collected again, the species should be easily recognized by the quadridentate clypeus.

2. APHODIUS SALLEI Harold

Aphodius sallei HAROLD, 1863, Berlin. Ent. Zeitschr., vol. 7, pp. 331, 336.—

BATES, 1887, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 84, pl. 6, fig. 10.

Aphodius (Bodilus) sallei SCHMIDT, 1913, Arch. Naturg., vol. 79A, fasc. 11, p. 166.

Convex, rufocastaneous, the vertex, disk of pronotum, suture and elytral striae, and metasternum piceous. Head of male with strong median tubercle, of female with tubercle obsolete, anterior margin of clypeus reflexed and subangulate on each side of median depression, surface closely and rather finely punctured. Frons with similar punctures adjacent to clypeofrontal suture, vertex polished and without punctures. Gena rounded, not more prominent than eye. Pronotum convex, sides nearly straight, lateral and basal margins finely beaded, anterior angles slightly produced but blunt, surface rather densely punctured with a mixture of fine and coarse punctures. Scutellum elongate-triangular, sparsely and finely punctured. Elytra together widest at apical third, at base slightly narrower than pronotum, striae coarse, strial punctures large, intervals convex, shining, sparsely and finely punctured. Pygidium with a scalelike ground sculpture, moderately finely and densely punctured, somewhat hairy. Posterior tibia fringed with a row of equal spinules, first segment of posterior tarsus very little shorter than next three segments combined, apical spine about as long as first segment. Length: 4–5 mm.

Type.—Possibly in collection of R. Oberthuer, Rennes.

Type locality.—Mexico.

Material examined.—In addition to a series of specimens from Texas and Mexico, 172 individuals from Jamaica and Hispaniola have been

studied. The species appears to be generally distributed in Jamaica to judge from the collections available. On the other hand, the species is not yet known from the Dominican Republic. All specimens from Hispaniola seen by the author have been taken in Haiti. Dr. R. E. Blackwelder secured series from Morne La Selle, Kenscoff, Trouin, and St. Marc. Three specimens from the Wickham collection are from Port-au-Prince. The distribution of the species suggests that its presence in the West Indian islands is the result of a comparatively recent importation.

2. *APHODIUS LIVIDUS* (Olivier)

Scarabaeus lividus OLIVIER, 1789, Entomologie . . . , Coléoptères, vol. 1, No. 3, p. 86, pl. 26, fig. 222.

Aphodius lividus CREUTZER, 1799, Entomologische Versuche, p. 44, pl. 1, fig. 7a.

Aphodius (Labarrus) lividus MULSANT, 1870, Ann. Soc. Agr. Lyon, ser. 4, vol. 2, p. 516.

Aphodius (Nialus) lividus REITTER, 1892, Verh. Naturf. Ver. Brünn., vol. 30, p. 202.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 316 (see this paper for more extended bibliography, including synonymy).

Aphodius luridus ARROW, 1903, Trans. Ent. Soc. London, p. 511 (*lapsus calami*).

Subconvex, pale yellow-brown, with anterior margin of frons, vertex, disk of pronotum, disks and suture of the elytra, and articulations of legs dark. Head with a low median tubercle on the clypeofrontal suture, clypeus obtusely angulate on each side of the slightly depressed median area, margin finely beaded, gena not produced laterally beyond eye, surface sparsely set with a mixture of large and small punctures. Pronotum with sides gently rounded and narrowly margined, base without marginal line, anterior angles acute but not prolonged, surface with punctation similar to that of head, no ground sculpture visible. Scutellum elongate triangular, with very few punctures. Elytra with striae finely incised, stria punctures fine, intervals flat and extremely finely punctured, the punctures becoming a little coarser on apical declivity. Pygidium rather densely punctured, set with short hairs with a few longer ones intermingled. Hind tibia fringed at apex with equal spinules, first segment of hind tarsus not so long as the next three combined. Length: 3.5–4.5 mm.

Type.—Location unknown to writer.

Type locality.—Environs of Paris, France.

Material examined.—In addition to many hundred specimens from other parts of the world, 380 West Indian specimens of *Aphodius lividus* have been examined by the writer in the course of this study. As the species is already known to have a nearly world-wide distribution, it is sufficient merely to indicate the islands from which specimens have been seen: Cuba, Jamaica, Hispaniola, Puerto Rico, Vieques, St. Thomas, St. John, St. Croix, St. Kitts, Antigua, Montserrat, Guadeloupe, Dominica, and Grenada.

4. *APHODIUS CUNICULUS* Chevrolat

Aphodius cuniculus CHEVROLAT, 1864, Ann. Soc. Ent. France, ser. 4, vol. 4, p. 411.
Aphodius (Nialus) cuniculus SCHMIDT, 1913, Arch. Naturg., vol. 79A, fasc. 11, p. 169.

Convex, rufopiceous with anterior and lateral margins of pronotum, lateral margins and apices of elytra, and legs rufous. Head with three small tubercles on the clypeofrontal suture, the median of which is the largest, clypeus with margin slightly reflexed, obtusely angulate on each side of the median depression, surface finely and rather densely punctured. Frons between eyes punctured as clypeus, vertex polished, without punctures. Gena separated from clypeus by an angular indentation, not more prominent than eye. Pronotum convex, sides gently curved, anterior angles blunt, lateral margins finely beaded, base without marginal line. Surface sparsely but evenly set with a mixture of very fine and very coarse punctures, and without ground sculpture. Scutellum elongate-triangular, without punctures. Elytra with striae rather deep. The stria punctures conspicuous, intervals moderately convex and sparsely set with extremely fine punctures, which become coarser on elytral declivity. Pygidium finely and densely sculptured, sparsely hairy. Hind tibia fringed at apex with row of equal spinules, first segment of hind tarsus shorter than the next three combined. Length: 3–4 mm. (5 mm. according to Chevrolat).

Type.—Location unknown to writer.

Type locality.—Cuba.

Material examined.—In all, 1,945 specimens, plus many broken ones discarded during the progress of the investigation, have been studied. This total comprises material from: Cuba, Jamaica, Hispaniola, Puerto Rico, Vieques, St. Thomas, St. John, St. Croix, St. Kitts, Antigua, Montserrat, Guadeloupe, Dominica, Martinique, St. Lucia, Barbados, St. Vincent, Carriacou, Grenada, and Tobago.

Genus *PLEUROPHORUS* Mulsant, 1842

Pleurophorus MULSANT, 1842, Histoire naturelle des Coléoptères de France, Lamellicornes, p. 312.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, pp. 469, 488.

Type of genus: *Scarabaeus caesus* Creutzer (by monotypy).

This genus of few species, one of which is becoming world-wide in its distribution, is represented in the West Indies by a single small form. As in *Saprosites*, the first segment of the hind tarsus is short and stout, but it is distinguished from that genus by the broad middle and hind femora as well as by the characters noted in the key. Many specimens of the closely related *P. batesi* (Arrow) have been taken from humus by means of Berlese funnel traps, and it is probable that most of the species of *Pleurophorus* are humus-living organisms.

PLEUROPHORUS PARVULUS (Chevrolat)

Psammobius parvulus CHEVROLAT, 1864, Ann. Soc. Ent. France, ser. 4, vol. 4, p. 415.

Psammobius parvulus ARROW, 1903, Trans. Ent. Soc. London, p. 514.

Diastictus parvulus SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 488.

Dark castaneous, head and all but extreme margins of pronotum piceous. Head strongly convex, gena slightly more prominent than eye and separated from clypeus by a feeble notch, clypeus with a shallow emargination at middle, edge on each side of the emargination reflexed, surface coarsely asperate, the asperities occasionally joining to form transverse ridges, vertex shining, with scattered small punctures. Pronotum with a shallow median groove on posterior half and with a similar transverse groove along anterior margin near each anterior angle. Lateral and basal marginal grooves deep and well defined. Surface shining, sparsely set with a mixture of very coarse and very fine punctures. Scutellum small, elongate, oval, minutely sculptured. Elytra with striae strong and deep, stria punctures not large, intervals convex, sparsely and minutely punctulate. Front femur with posterior face shining and with groove present only along anterior margin. Posterior tarsus shorter than tibia, first segment as long as the next two combined, upper spur very little longer than first segment. Length: 2-2.5 mm.

Type.—Location not known to writer.

Type locality.—Cuba.

Material examined.—In all, 41 specimens of this species have been studied. These come from the islands of Cuba, Jamaica, St. Croix, and Dominica. Most of the specimens seen had been collected at dusk while flying. This bears out the observations recorded by Mr. Arrow in his paper on the St. Vincent and Grenada species. It is probably a humus feeder, as is its close relative on the mainland, *Pleurophorus batesi* Arrow.

Records of this species from the mainland of both Central and North America probably refer to *P. batesi* Arrow and not to *P. parvulus* Chevrolat. The writer has examined more than a hundred North American specimens, all of which agree with the Mexican rather than the West Indian species.

After a study of the type species of the genera *Pleurophorus* and *Diastictus*, it appears that both *P. parvulus* and *P. batesi* must be associated with *Pleurophorus caesus* (Creutzer) rather than with *Diastictus vulneratus* (Sturm) if these genera are maintained as distinct. Since the two are separated only by the difference in the relative length of the posterior tibial spur and relative length of posterior tarsus to tibia, characters of no fundamental importance, it would be best to merge the two under one name.

Genus PSAMMODIUS Fallén, 1807

Psammodius FALLÉN, 1807, Observationes entomologicae, fasc. 3, p. 37.—GYLLENHAL, 1808, Insecta Suecica . . . , Coleoptera, vol. 1, pt. 1, p. 6.—CURTIS, 1829, British entomology, vol. 6, No. 258.—HEER, 1841, Fauna coleopterorum Helvetica, vol. 1, fasc. 3, p. 532

Psammobius HEER, 1841, Fauna coleopterorum Helvetica, vol. 1, fasc. 3, p. 531.

Type of genus: *Aphodius sulcicollis* Illiger (by subsequent designation of Curtis, 1829).

This genus, usually credited to Gyllenhal, 1808, was originally proposed by Fallén in the previous year. The originally included species were seven in number as follows: *Scarabaeus arenarius* Paykull, *Aphodius globosus* Illiger, *A. elevatus* Fallén, *A. sabuleti* Fallén, *A. porcatus* Fallén, *A. asper* Fallén, and *A. sulcicollis* Illiger. Curtis, 1829, choosing to preserve the name *Psammodius* free of conflict with *Aegialia* Latreille, 1807, selected the last species, *A. sulcicollis* Illiger, as type. This action is strictly in accord with the International Rules and must be accepted. There was therefore no cause for Heer, 1841, to shift the type from *A. sulcicollis* Illiger to *A. sabuleti* Fallén, thereby killing the name as a subjective synonym of *Aegialia*, and to propose a new name, *Psammobius*, to include *A. sulcicollis* Illiger.

The genus is included in the West Indian fauna by virtue of a single specimen from Puerto Rico. It is possible that this represents a recent importation from North America.

PSAMMODIUS BIDENS Horn

Psammodius bidens HORN, 1871, Trans. Amer. Ent. Soc., vol. 3, p. 293; 1887, loc. cit., vol. 14, p. 92.

Psammobius cruentus SCHMIDT, 1922, Das Tierreich, pars 45, Aphodiinae, p. 478 (incorrect synonymy).

Dark castaneous above, head and pronotum slightly paler, underparts bright rufous. Anterior margin of head with a sharp triangular tooth each side of the median shallow emargination, sides of head gradually and evenly rounded to the genal lobes. Front coarsely and rather densely verrucose, vertex polished and very finely and very sparsely punctate. Pronotum strongly convex, with fine, short marginal setae, marginal groove fine, replaced across base by a series of coarse punctures. Surface shining, ornamented with punctures of two distinct sizes: The entire surface evenly, sparsely, and very finely punctured, and in addition the disk is sparsely set with rather coarse punctures. No trace of basal transverse impression, but each anterior angle with a short, deep, strongly punctured groove. Elytral striae deep, strial punctures coarse and well defined, intervals slightly convex, very finely and irregularly punctured. Lateral margin blunt,

epipleura dull. Pygidial carina feeble, median cusp strong. Lateral areas of metasternum finely sculptured, median area and that portion of lateral area adjacent to posterior coxa shining, very finely and sparsely punctured, median groove deep and fine, not abruptly terminated either anteriorly or posteriorly. Abdominal sternites feebly verrucose laterally, median areas smooth, basal transverse rows of pits fine but sharply defined. Anterior femur with ill-defined groove along anterior margin, surface shining, sparsely punctured near posterior margin. Posterior femur strongly inflated, without marginal groove, surface shining, sparsely and minutely punctured, with three or four coarse punctures near the insertion of tibia. Middle and posterior tibiae each with one well-defined transverse ridge and with traces of two others above. Longer apical spur of posterior tibia broad, twisted, and as long as the first three tarsal segments combined. Length: 3-4 mm.

Type.—In the Academy of Natural Sciences, Philadelphia.

Type locality.—Southern United States, probably Georgia.

Material examined.—Many specimens from Southeastern United States and one specimen taken on beach at Humacao, Puerto Rico, October 8, 1935, Blackwelder station 56.

The writer does not accept the synonymy of Horn's species with *P. cruentus* (Harold) of the Argentine. It is evident from Schmidt's 1922 paper that he had not seen a specimen of the true *P. bidens* (Horn). The transverse ridges on the middle and hind tibiae are well marked, and the species runs in Schmidt's key to *P. ambiguus* Fall and Cockerell, from which it is easily distinguished.

Genus SAPROSITES Redtenbacher, 1858

Saprosites REDTENBACHER, 1858, *Fauna Austriaca*, ed. 2, p. 436.—BATES, 1887, *Biologia Centrali-Americana*, Coleoptera, vol. 2, pt. 2, p. 92.—REITTER, 1892, *Verh. Naturf. Ver., Brünn.*, vol. 30, pp. 157, 169.—SCHMIDT, 1922, *Das Tierreich*, pars 45, Aphodiinae, pp. 389, 398.

Type of genus: *Saprosites peregrinus* Redtenbacher, 1858 (by monotypy).

In habitus the species of this genus closely resemble certain *Ataenius*, such as *A. gracilis* (Melsheimer). They are easily distinguished by the shorter and stouter tarsi and by the short but clearly defined transverse ridges on the middle and hind tibiae. Most of the species are found in the warmer parts of the world but a few occur in the Palaearctic and Nearctic regions. In the Western Hemisphere, a species, *S. ventralis* (Horn), has long been listed in the genus *Pleurophorus* but is a true and quite typical *Saprosites*. One collection of this species was made by H. S. Barber at Marlboro, Md., in the galleries of *Popilius disjunctus* (Illiger), where it

may have been feeding on the frass pellets. In other cases, species have been recorded as collected under bark. As yet but two species of this genus have been found in the West Indies. These may be separated as follows:

1. Abdominal sternites very thickly and finely punctured; anterior tibia with denticle between upper two of the three major teeth; length 4 mm-----1. *grenadensis* Arrow
- Abdominal sternites moderately thickly and coarsely punctured; anterior tibia without denticle between upper two of the major teeth; length 3 mm-----2. *blackwelderi*, new species

1. *SAPROSITES GRENADENSIS* Arrow

Saprosites grenadensis ARROW, 1903, Trans. Ent. Soc. London, p. 514.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 412.

Related to *S. parallelus* Harold but smaller and with finer punctation. Rufopiceous, with head and pronotum more definitely red. Pronotum simply but irregularly punctate, elytra deeply striate, the stria punctures not very distinct. Metasternum broadly canaliculate, abdominal segments densely and finely punctured. Anterior tibia with three major teeth, with a minute tooth between the upper two of the three. Length: 4 mm.

Type.—In the British Museum.

Type locality.—Grenada, Grand Étang (1,900 feet).

Material examined.—The writer has not seen any specimens of this species. The description has been taken from the original publication.

2. *SAPROSITES BLACKWELDERI*, new species

Moderately convex-cylindrical, pronotum slightly wider than elytra at base; castaneous with margins of pronotum and elytra darker. Head convex, clypeus with broad, shallow emargination at middle, surface near the strongly beaded edge asperate, remaining surface moderately densely but not very finely punctured, genal lobe small but more prominent than eye. Pronotum slightly wider than long, nearly quadrate, surface sculpture similar to that of head, lateral margins finely beaded, base not margined, anterior angles nearly right, posterior angles very broadly rounded. Scutellum elongate, small, without punctures. Elytra deeply striate, stria punctures moderately coarse, intervals finely and rather densely punctured, humeral angles strongly denticulate. Pygidium with broad, deep, and sharply defined median groove on basal half, which is minutely punctulate, apical half shining and rather coarsely punctured, transverse carina feebly indicated. Abdomen with sternites fused but with transverse sutures plainly indicated, coarsely and moderately densely punctured. Front femur with marginal groove at anterior margin of posterior face only, tibia

with three large teeth, the upper two of which are close together without an intercalated denticle, middle and hind tibiae each with a trace of an oblique ridge, tarsi short and stout, claws very small. Length: 3 mm.

Type and paratypes.—U.S.N.M. No. 53319.

Type locality.—Mayaguez, Puerto Rico.

Material examined.—Three specimens taken at the type locality on January 6, 1937 (Blackwelder station 358); one specimen from Añasco, Puerto Rico, October 25, 1935, by R. G. Oakley (San Juan No. 6369). All specimens were taken in rotting wood.

Genus ATAENIUS Harold, 1867

Ataenius HAROLD, 1867, Coleopterologische Hefte, vol. 1, p. 82; vol. 2, p. 100.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 413.

Type of genus: *Ataenius scutellaris* Harold, 1867 (by monotypy).

While this genus is usually cited as from page 100 of the second part of the Coleopterologische Hefte, it was actually established on page 82 of the first part. Fortunately there appears no conflict in usage in the two places. An earlier name, *Auperia* Duval, is not available as it is an intended emendation of *Euparia* Lepeletier and Serville and therefore takes the same type as that genus.

The species of *Ataenius* are mostly inhabitants of the Tropics or the Southern Hemisphere. A few are found in North America and a very few enter the Palaearctic region. The habits of the various species are somewhat diverse, some being attracted to the excrements of higher animals and some living beneath vegetable debris.

KEY TO WEST INDIAN SPECIES OF ATAENIUS

1. Pygidium without acute transverse carina, apical portion convex and polished; clypeal margin in fresh specimens obtusely denticulate each side of median emargination; integuments strongly shining; femora, metasternum, and abdominal sternites impunctate.....1. *haroldi* Steinhell
Transverse carina acutely raised, joined at ends to marginal carina; apical portion (enclosed by these carinae) concave and strongly alutaceous.....2
2. Clypeal margin distinctly denticulate each side of median emargination; integuments dull.....3
Clypeal margin broadly rounded each side of median emargination.....8
3. Posterior femur with a deep groove extending along entire posterior margin.....4
Posterior femur without groove or with feeble groove near insertion of tibia.....5
4. Punctures on frons nearly uniform in size; punctures on pronotum moderately coarse, neither crowded nor confluent.....2. *steinhelli* Harold

- Punctures on frons coarse near eyes, becoming exceedingly fine toward anterior margin; punctures on pronotum very coarse, crowded and subconfluent at base.....3. *beattyi*, new species
5. Front of head except adjacent to clypeal margin rather closely set with coarse, elongate punctures; extreme marginal area transversely rugulose; discal elytral intervals nearly flat, each with a series of punctures.....4. *abditoides*, new species
- Front of head near eyes sparsely to densely set with round punctures, lower (anterior) portion irregularly and rather coarsely rugulos..... 6
6. Elytral intervals on disk carinate, each carina broken into a series of shining points; pronotum with a very shallow longitudinal groove reaching from point just before the scutellum to about half length of pronotum.....5. *vincentiae* Arrow
- Elytral intervals on disk flat or convex, not carinate; pronotum without trace of median longitudinal groove..... 7
7. Pronotum swollen posterolaterally so as to overhang the posterolateral margin; discal punctures very coarse, mostly separated by less than their diameters; punctures on intervals of elytra coarse.....6. *corrosus*, new species
- Pronotum normal, not overhanging margin at any point; discal punctures coarse, mostly separated by more than their diameters; punctures on intervals of elytra fine.....7. *abditus* (Haldeman)
8. Pronotum unusually short, hardly more than one-third as long as elytra; anterior femur thin, oblong, with fine marginal groove; posterior femur slender.....27. *brevinotus*, new species
- Pronotum normal, almost half as long as elytra; femora normal for genus..... 9
9. Anterior femur beneath without marginal groove.....28. *terminalis* (Chevrolat)
- Anterior femur beneath grooved at least along anterior margin.....10
10. Posterior femur with groove along posterior margin, which may reach the entire length of femur or which may be present only in its apical portion.....11
- Posterior femur without groove along posterior margin.....19
11. Upper surface opaque, elytral punctures set with minute setae; posterior femur with entire groove.....12
- Upper surface shining, elytral punctures mostly without setae; posterior femur with groove usually abbreviated.....14
12. Setae on elytra suberect, conspicuous; pronotal punctures very coarse, tending to coalesce at sides.....8. *imbricatus* (Melsheimer)
- Setae on elytra closely appressed, not visible except with high magnification; pronotal punctures less coarse, discrete.....13
13. Elytral intervals subcarinate, scutellum broader at base than long, punctures on intervals near scutellum moderately coarse.
9. *miamii* Cartwright
- Elytral intervals flat, scutellum longer than width at base, punctures on intervals near scutellum exceedingly fine.....10. *tenebrosus* Arrow
14. Posterior femoral groove reaching nearly to insertion of femur; outer elytral interval (adjacent to lateral margin) opaque.....20. *frater* Arrow
- Posterior femoral groove abbreviated, only on apical half of femur; outer elytral interval not noticeably different from others.....15

15. Metasternum near middle trochanters with a cluster of very coarse punctures, which are not a continuation of lateral sculpture.....19. *strigicauda* Bates
Metasternum evenly and sparsely punctured on median area, without such a cluster of very coarse punctures.....16
16. Form slender; pronotum with a shallow median longitudinal groove on basal half; median portion of metasternum moderately coarsely punctured.....12. *gracilis* (Melsheimer)
Form robust; pronotum without median groove; median portion of metasternum very finely punctured.....17
17. Metasternum except for median portion and a narrow area adjacent to posterior coxae finely to coarsely sculptured; anterior femur beneath coarsely and sparsely punctured.....16. *cribrithorax* Bates
Metasternum finely and densely sculptured near extreme lateral margin only; anterior femur with a few coarse punctures near posterior apical margin.....18
18. Size large, length more than 4.5 mm; ninth elytral interval (sutural=first) densely punctulate, tenth interval impunctate.
18. *darlingtoni* Hinton
Size small, length less than 4.5 mm; ninth interval not noticeably more densely punctate than tenth.....17. *ilogaster* Bates
19. Pronotal punctures in any area more or less uniform in size; that is, at no place is there a mixture of coarse and very fine punctures.....20
Pronotum with coarse punctures densely or sparsely placed, always with an admixture of very fine punctures scattered between coarse ones.....22
20. Elytra bicolored, sutural to fifth and seventh intervals piceous on disk; sixth and eighth to tenth intervals and apex broadly luteous; pronotal punctures coarse.....21. *jamaicensis*, new species
Elytra uniform piceous to black.....21
21. Luster subopaque, elytral intervals moderately coarsely punctured, pronotal punctures coarse, length up to 4 mm.
11. *subopacus*, new species
Luster shining, elytral intervals very finely punctured, pronotum strongly transverse, finely and densely punctured, length 5 mm or more.....13. *elongatus* (Palisot)
22. Metasternum with small patch of setigerous punctures.....23
Metasternum without setae.....24
23. Setae confined to anterior half of median area of metasternum; pronotum not strongly convex from side to side, its marginal setae unusually long.....25. *sulcatulus* (Chevrolat) (♂)
Setae confined to posterior half of median area of metasternum; pronotum normally convex, its marginal setae not unusually long.....14. *edwardsi*, new species
24. Lateral intervals and apices of elytra conspicuously setose.....25
Lateral intervals and apices of elytra with at most a few minute setae, visible only with high magnification.....26
25. Middle femur with deep and entire marginal groove; middle and posterior femora coarsely punctured in apical half.....22. *aciculus* Hinton
Middle femur without marginal groove; middle and posterior femora finely and sparsely punctured.....23. *versicolor* Schmidt

26. Posterior femur without fringe of long setae along basal half of inner anterior margin; sides of pronotum coarsely and densely punctured, punctures separated by less than their own diameters.....15. *insulicola*, new species
 Posterior femur with such a fringe; sides of pronotum sparsely punctured, punctures separated usually by more than twice their diameters..... 27
27. Elytra usually (always?) bicolored, apices and outer intervals pale; vertex densely punctured.....24. *luteomargo*, new species
 Elytra uniform piceous; vertex sparsely punctured.
 25. *sulcatulus* (Chevrolat) (♀)

1. *ATAENIUS HAROLDI* Steinheil

Ataenius haroldi STEINHEIL, 1872, Atti Soc. Ital. Sci. Nat., vol. 15, p. 556.

Ataenius figurator HAROLD, 1874, Coleopterologische Hefte, vol. 12, p. 24.—BATES, 1887, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 99.—HORN, 1887, Trans. Amer. Ent. Soc., vol. 14, p. 79.—SCHMIDT, 1922, Das Tierreich, pars 45, p. 435.

Piceous, strongly shining, sides of pronotum, underparts of thorax, and legs bright castaneous, trophi and antennae pale. Anterior margin of head with a small denticle (in fresh specimens) each side of the slight median emargination. Front sparsely and finely punctured, its anterior two-thirds rather coarsely and transversely rugulose, vertex more coarsely and densely punctured. Pronotum apparently devoid of marginal setae, margin evenly curved from middle point of base to broadly rounded anterior angles, marginal groove fine and complete. Surface highly polished, set with punctures of two sizes—very fine ones, which are evenly but not densely distributed, and a few very coarse ones, which are more abundant laterally. Elytral striae rather fine but deep, stria punctures well marked, intervals smooth and flat, not subcarinate at apex, each sparsely set with very minute punctures. Lateral margin low and blunt, epipleura shining. Pygidium with the usual separation into a basal, longitudinally grooved portion and an apical portion but with the dividing line not carinate, apical portion convex and shining, minutely punctulate. Mesosternum and sides of metasternum shagreened, median portion of latter, abdominal sternites and legs virtually impunctate. Basal transverse row of pits on each sternite fine but distinct. Anterior femur with trace of marginal groove only on anterior margin near insertion of tibia, posterior femur without marginal groove, posterior tibia without accessory spine. Length: 3-4 mm.

Type.—Location unknown to writer.

Type locality.—San Luis, Argentina (*haroldi*); Louisiana, U. S. A. (*figurator*).

Material examined.—Eighteen specimens of West Indian origin as well as many from Louisiana and other parts of North America and series from Mexico and Argentina. Of the 18, four are from Cuba, seven from Hispaniola (La Moriniere, Haiti), and seven from Puerto Rico.

There seems little doubt that this species is identical with *A. haroldi* Steinheil, 1872, notwithstanding the fact that Schmidt (1922) maintains the two as distinct. In the original description, Harold states that *figurator* can be separated from *haroldi* only by the absence of clypeal teeth. Certainly clypeal denticles are present in fresh specimens of *figurator* from the type locality. This fact was pointed out by Horn and Bates and is substantiated by the present investigations. The species is immediately recognized by the convex and polished apical half of the pygidium.

2. *ATAENIUS STEINHEILI* Harold

Ataenius steinheili HAROLD, 1874, Coleopterologische Hefte, vol. 12, p. 18.

Piceous-black when clean but usually covered with an incrustation so as to appear gray, legs and trophi castaneous. Anterior margin of head rather strongly denticulate each side of shallow median emargination. Front rather coarsely and closely set with round punctures except for the marginal area, which is polished, vertex more coarsely punctured. Pronotum with marginal setae short, marginal groove complete but not conspicuous. Surface evenly and rather densely set with punctures which are less coarse and are crowded as the median area is approached. Hind angles obliterated by shallow emargination. Elytra with broad and deep striae, stria punctures conspicuous, intervals subacutely carinate except outer one where carina is replaced by a few polished points, each carina with an irregular double row of rather fine punctures and bordered each side by fine grooves. Lateral margin acute, epipleura opaque. Pygidial carina with feeble median cusp. Mesosternum rough, as are the sides of the metasternum. Median area of latter shining, strongly punctured, median groove conspicuous but not abruptly terminated. Abdominal sternites strongly and rather coarsely punctured, transverse basal row of pits on each sternite well defined, these pits especially deep and elongate on last two sternites. Anterior femur beneath with deep perimarginal groove, the surface densely and coarsely punctured. Posterior femur slender, shining, with groove on posterior margin, surface more finely and sparsely punctured; posterior tibia with accessory spine. Length: 4-4.5 mm.

Type.—Possibly in collection of R. Oberthuer.

Type locality.—New Granada (Colombia) between Baranquilla and Mompox, on the Magdalena River.

Material examined.—Thirty specimens from Grenada, taken January 10, 1936, in cow dung 2 miles west of Grand Anse on the peninsula of Point Saline (Blackwelder station 131). I have also studied a single specimen from Port of Spain, Trinidad, November 24, 1935 (Blackwelder station 94) and one from General Ballivian, Prov. Salta, Argentina, collected by Dr. G. L. Harrington.

3. *ATAENIUS BEATTYI*, new species

Sooty black, anterior margins of head and pronotum and legs castaneous, antennae and trophi paler. Anterior margin of head denticulate each side of the broad and shallow median emargination. Front rather coarsely punctured near eyes, the punctures becoming very fine toward the median anterior area, marginal area polished and free of punctures, vertex very coarsely and confluent punctured. Pronotum with marginal setae short and stout, marginal groove complete but evanescent at anterior angles. Surface coarsely, cribrately, and subconfluent punctured, the punctures slightly smaller toward the anterior margin. Hind angles shallowly emarginate. Elytra with broad and deep striae, stria punctures coarse and conspicuous, intervals subacutely carinate except outer one, which is very deeply set, plane, and strongly alutaceous, each carina with an irregular double row of fine punctures but not bordered by distinct grooves. Lateral margin acute, epipleura opaque. Pygidial carina with a strong median cusp, which is sometimes continued across the face of the pygidium as a fine carina. Sides of metasternum very rough, median area somewhat shining, coarsely and densely punctured, median groove deep, abruptly terminated behind. Abdominal sternites very coarsely and rugosely punctured, transverse basal rows of pits on each sternite well defined, these pits especially deep and elongate on last two sternites. Anterior femur with perimarginal groove, the surface coarsely and rugosely sculptured. Posterior femur somewhat shining, with posterior marginal groove complete, surface more finely but rather densely punctured; posterior tibia with accessory spine. Length: 3.5–4 mm.

Type and paratypes.—U.S.N.M. No. 53320.

Type locality.—St. Croix, Virgin Islands.

Material examined.—Six specimens from St. Croix, five of which were taken in dung November 29, 1936, by H. A. Beatty and R. E. Blackwelder (Blackwelder station 339); 38 specimens from Constant Spring, Jamaica, April 1931; one from St. Thomas, Virgin Islands, October 21, 1935 (Blackwelder station 68), and one from Barbados, March 12, 1936 (Blackwelder station 195).

4. ATAENIUS ABDITOIDES, new species

? *Ataenius exoratus* FLEUTIAUX and SALLÉ, 1889, Ann. Soc. Ent. France, ser. 6, vol. 9, p. 397.

? *Ataenius polyglyptus* var. *jalapensis* ARROW, 1903, Trans. Ent. Soc. London, p. 513 (not Bates).

Piceous-black, apices of tibiae, tarsi, and trophi paler. Anterior margin of head moderately strongly denticulate each side of shallow median emargination. Front rather densely set with elongate oblong punctures except for the median area adjacent to the emargination where the surface is coarsely granulate; vertex densely set with coarse round punctures. Pronotum broadly and evenly rounded from center point on base to point above eye, marginal setae inconspicuous, marginal groove entire but fine. Surface densely, evenly, and coarsely punctured. Elytral striae not coarse, strial punctures well defined, intervals flat on disk becoming subacutely carinate near apex, each with a single row of moderately coarse punctures, surface strongly alutaceous. Lateral margin subacutely cariniform, epipleura opaque. Pygidial carina with a well-defined median cusp. Mesosternum and lateral portions of metasternum shagreened, median area of latter strongly shining, coarsely and rather densely punctured. Median groove deep, abruptly terminated behind. Abdominal sternites with punctures similar to those on the median area of metasternum. Transverse basal rows of pits poorly defined. Anterior femur with perimarginal groove, the surface roughly sculptured but without clearly defined punctures. Posterior femur with short marginal line near insertion of tibia, surface shining, sparsely set with well-defined punctures; posterior tibia without accessory spine. Length: 4 mm.

Type and paratypes.—U.S.N.M. No. 53321.

Type locality.—St. Lucia, British West Indies.

Material examined.—Six specimens from St. Lucia, three of which were taken under trash on bank of Milette River near junction with Roseau River, April 3, 1936 (Blackwelder station 211) and three from nearby on the Roseau River, April 1936 (Blackwelder station 209). One specimen from St. Vincent, 6 miles north of Kingstown, February 15, 1936 (Blackwelder station 176), and two from Tacarigua, Trinidad, December 22, 1935 (Blackwelder station 107).

The identity of *A. exoratus* Fleutiaux and Sallé with this species is far from certain. The short description of *exoratus* is not sufficient to separate *abditoides* from *subopacus*, described later in this paper. It is probable that one or the other should be called *exoratus*. It may also be the species recorded from Grenada and St. Vincent by Arrow (1903) as *A. polyglyptus* var. *jalapensis* Bates. The writer has been able to examine a specimen of this last from the British Museum and finds it to be the same as *A. abditus* Haldeman. The sculpture of the heads of these two species is quite different.

5. *ATAENIUS VINCENTIAE* Arrow

Ataenius vincentiae ARROW, 1903, Trans. Ent. Soc. London, p. 513.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 450.

Piceous-black, not shining, legs castaneous, antennae and trophi paler. Anterior margin of head denticulate each side of very shallow median emargination. Front near eyes densely and finely punctured, more than anterior half coarsely and irregularly rugose, vertex moderately coarsely and densely punctured. Pronotum with marginal setae very inconspicuous, marginal grooves complete but ill defined. Surface very densely and evenly punctured, the punctures slightly more coarse than those on vertex. Elytral striae rather fine but clearly defined, stria punctures evident but not conspicuous, intervals flat but each with the median line acutely carinate, each carina broken into a series of oblong points and with each break furnished with a minute seta. Surface otherwise coarsely alutaceous. Lateral margin acute, epipleura dull. Pygidial carina with a strong median cusp. Mesosternum and lateral areas of metasternum shagreened, median area of latter shining, coarsely and not densely punctured, median groove terminated abruptly anteriorly. Abdominal sternites moderately coarsely and rather densely punctured, basal transverse rows of pits poorly defined except on terminal sternite. Anterior femur with deep marginal groove on anterior margin, surface coarsely and rugosely punctured. Posterior femur with trace of marginal groove near insertion of tibia, surface shining, sparsely and not coarsely punctured; posterior tibia without apical spine. Length: 3.3–3.5 mm.

Type.—In the British Museum.

Type locality.—St. Vincent, British West Indies.

Material examined.—A specimen from the type series by courtesy of G. J. Arrow. Also two specimens from St. Vincent, February 10, 1936, R. E. Blackwelder (station 170), one specimen from 25 km. (by road) south of Puerto Plata, Dominican Republic, June 1938, P. J. Darlington, one specimen from Coamo Springs, Puerto Rico, Dec. 27, 1914, and two specimens from Coamo, Puerto Rico, March 24, 1929, S. T. Danforth. There is also a specimen from La Ceiba, El Salvador, Vera Wellborn, in the National Collection.

6. *ATAENIUS CORROSUS*, new species

Piceous, feebly shining, anterior margins of head and pronotum and legs castaneous, antennae and trophi pale. Anterior margin of head denticulate each side of shallow median emargination. Front and vertex densely and moderately coarsely punctured, the punctures becoming finer anteriorly, region adjacent to anterior margin coarsely and irregularly rugulose and free of punctures. Pronotum with marginal setae inconspicuous and with marginal groove very broad and

deep. Side portions of pronotum strongly swollen, from anterior angles to points directly above the origins of the third elytral striae, so that, as seen from above, the posterolateral margin is concealed. Surface moderately densely and very coarsely punctured; in general, each puncture is separated from its nearest neighbor by less than its diameter. Elytral striae coarse and deep, stria punctures coarse and slightly off center, so that they encroach on the inner margin of each interval. Intervals subconvex, alutaceous, each with a single row of moderately coarse punctures along its outer margin. Lateral margin subacute, epipleura subopaque and coarsely punctured. Pygidial carina with a moderately strong median cusp. Metasternum laterally opaque, finely and densely sculptured, median area shining, coarsely and sparsely punctured, median groove deep, abruptly terminated both anteriorly and posteriorly. Abdominal sternites coarsely and sparsely punctured, basal transverse rows of pits sharply defined. Anterior femur with perimarginal groove, surface coarsely and densely punctured. Posterior femur with trace of marginal groove near insertion of tibia, surface shining, moderately coarsely and sparsely punctured; posterior tibia without accessory spine. Length: 3.5 mm.

Type and paratype.—Museum of Comparative Zoology No. 23555. Paratype: U.S.N.M. No. 53322.

Type locality.—Aguadores, Prov. Oriente, Cuba.

Material examined.—Type and two paratypes from the above locality, June 6, 1936, Dr. P. J. Darlington, Jr.

7. ATAENIUS ABDITUS (Haldeman)

Aphodius (Oxyomus) additus HALDEMAN, 1848, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 1, p. 106.

Ataenius additus GEMMINGER and HAROLD, 1869, Catalogus coleopterorum . . . , vol. 4, p. 1066.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodiinae, p. 449.

Piceous to black, anterior margin of head and pronotum and legs castaneous, antennae and trophi paler. Anterior margin of head finely denticulate each side of shallow median emargination, lateral margin nearly straight from denticles to genae. Front and vertex moderately coarsely and rather densely punctured, the punctures becoming finer anteriorly, extreme anterior margin feebly rugose and free from punctures. Pronotum with marginal setae short and inconspicuous, marginal groove moderately fine across base, broader laterally. Surface shining, coarsely and rather densely punctured, the punctures rather sparse on disk and slightly finer anteriorly. Elytral striae moderately fine and deep, stria punctures rather coarse and off center, encroaching on the inner margin of each interval. Intervals nearly flat, finely alutaceous, each with a single row of fine punctures along its outer margin. Lateral margin acute, epipleura

subopaque and irregularly sculptured. Pygidial carina with a moderately strong median cusp. Metasternum opaque and finely sculptured laterally, median area shining, coarsely and rather sparsely punctured, median groove deep, abruptly terminated anteriorly and posteriorly. Abdominal sternites coarsely and sparsely punctured, basal transverse rows of pits clearly defined. Anterior femur with strong anterior marginal groove, surface rather coarsely and densely punctured. Posterior femur with short marginal groove near insertion of tibia, surface shining, rather finely and sparsely punctured; posterior tibia without accessory spine. Length: 3.5 mm.

Type.—Probably at Museum of Comparative Zoology.

Type locality.—"Middle States," presumably near Pennsylvania.

Material examined.—In addition to several hundred specimens from the mainland of North America, a series of 20 specimens from Ennery, Haiti, near 1,000 feet, September 5–11, 1934, P. J. Darlington, and a single specimen from Camp Perrin, Haiti, near 1,000 feet, October 8–27, 1934, Darlington, have been studied.

There is some variation in this species as regards the punctuation of the front in the North American series, the punctures apparently becoming progressively finer the farther west the specimen is collected. The Haiti series agrees closely with the northeastern representatives.

8. *ATAENIUS IMBRICATUS* (Melsheimer)

Aphodius imbricatus MELSHEIMER, 1844, Proc. Acad. Nat. Sci. Philadelphia, new ser., vol. 2, p. 136.

Ataenius imbricatus GEMMINGER and HAROLD, 1869, Catalogus coleopterorum, vol. 4, p. 1066.—HORN, 1871, Trans. Amer. Ent. Soc., vol. 4, p. 285; 1887, loc. cit., vol. 14, p. 74.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 443.

Ataenius sordidus HAROLD, 1869, Coleopterologische Hefte, vol. 5, p. 103.

Piceous-black but almost always covered with a gray incrustation, legs, antennae, and trophi paler. Anterior margin of head broadly rounded each side of median emargination, front coarsely reticulate-punctate but becoming simply punctate and finally smooth toward margin, the punctures tending to form longitudinal rows laterally, vertex even more coarsely reticulate than upper part of front, each reticulation on front giving rise to a short stout seta. Pronotum with marginal setae, marginal groove present at sides but absent across middle portion of base. Surface coarsely and closely punctured, except along median line near base where punctures are more sparse, each puncture bearing a short seta. Elytral striae deep but poorly defined, strial punctures not evident, intervals evenly convex, not carinate, each with a few irregularly placed short setae. Lateral margin subacutely carinate, epipleura opaque. Pygidial carina with a strong median cusp. Mesosternum, side portions of metasternum

and of abdominal sternites roughly sculptured, median portions of metasternum and abdominal sternites somewhat shining, shallowly rugose-punctate. Median groove of metasternum poorly defined. Anterior femur with a poorly defined groove on anterior margin, surface roughly sculptured. Posterior femur with a broad, poorly defined groove along almost the entire length of the posterior margin; posterior tibia without accessory spine. Length: 3.5–4 mm.

Type.—Possibly at Museum of Comparative Zoology.

Type locality.—Pennsylvania, U. S. A. (*imbricatus*); Texas to Ega (*sordidus*).

Material examined.—In addition to about 50 specimens from Pennsylvania and other parts of North America, the writer has studied a series of 142 specimens from Baragua, Camaguey, Cuba, mostly taken in June by L. D. Christenson; three specimens from Cayamas, Santa Clara, Cuba, May and June, E. A. Schwarz; and two specimens from Santa Clara Prov., Cuba, June 16, 1932, F. de Zayas (collection of O. L. Cartwright). Further, a series of seven specimens from Puerto Plata, Dominican Republic, July 20, 1937, W. J. Clench, and two from Bahamas (Nassau and Arthurs Town), these latter in the collection of the Museum of Comparative Zoology, and two specimens from Andros Island, May–June 1917, W. M. Mann, in the collection of the American Museum of Natural History.

9. *ATAENIUS MIAMII* Cartwright

Ataenius miami CARTWRIGHT, 1934, Can. Ent., vol. 66, p. 200.

Piceous, opaque, anterior margin of head shining castaneous, legs castaneous, anterior tarsi, antennae, and trophi paler. Anterior margin of head broadly rounded each side of the broad median emargination, narrowly impunctate, front moderately coarsely punctured at sides, the punctures tending to coalesce in short longitudinal channels, median portion rather sparsely punctured, vertex rather coarsely and very densely punctured. Pronotum with marginal setae inconspicuous, marginal groove complete, surface densely and rather evenly punctured, the punctures very coarse but not coalescent at sides, finer toward anterior part of disk. Elytral striae broad and deep, stria punctures coarse, intervals finely alutaceous, each subacutely carinate and bearing a row of setigerous punctures along its outer margin, setae very short. Lateral margin carinate, epipleura somewhat shining, finely sculptured. Pygidial carina with a moderately strong median cusp. Metasternum somewhat shining, finely sculptured laterally, median area coarsely and sparsely punctured, median groove abruptly terminated behind. Abdominal sternites coarsely but very shallowly punctured, basal transverse row

of pits on each sternite fine but distinct. Anterior femur with perimarginal groove, surface densely and finely punctured. Posterior femur with posterior marginal groove, surface sparsely and finely punctured; posterior tibia without accessory spine. Length: 3-3.7 mm.

Type and paratypes.—U.S.N.M. No. 50764.

Type locality.—Miami, Florida, U. S. A.

Material examined.—The type, two paratypes, and six other specimens, two each from St. Croix, St. Kitts, and Barbados. The Barbados specimens are in the collection of the British Museum.

This species is somewhat similar to *A. tenebrosus* Arrow but is distinguished immediately from that species by the oval shape of the hind body and by the setigerous punctures of the elytra.

10. *ATAENIUS TENEBROSUS* Arrow

? *Ataenius picipes* FLEUTIAUX and SALLÉ, 1889, Ann. Soc. Ent. France, ser. 6, vol. 9, p. 397.

Ataenius tenebrosus ARROW, 1903, Trans. Ent. Soc. London, p. 512.

Piceous, opaque, anterior margin of head shining castaneous, legs castaneous, antennae, tarsi, and trophi paler. Anterior margin of head broadly rounded each side of the broad and not deep median emargination, narrowly impunctate, front coarsely punctured, the punctures coalescing to form irregular longitudinal channels, vertex coarsely and densely set with discrete punctures. Pronotum with marginal setae inconspicuous, marginal groove entire, extreme margin somewhat explanate. Surface dull, densely punctured, the punctures laterally very coarse and cribrate, those on anterior portion of disk finer and distinctly separated. Elytral striae deep, stria punctures coarse, intervals not strongly convex, surface coarsely alutaceous, almost scaly, without visible punctures. Humeral angle unusually sharply produced. Lateral margin carinate, epipleura dull. Pygidial carina with strong median cusp. Metasternum somewhat shining at middle, lateral areas finely and densely sculptured, median area coarsely and sparsely punctured, median groove abruptly terminated both anteriorly and posteriorly. Abdominal sternites coarsely and rather sparsely punctured, basal transverse row of pits on each sternite well defined. Anterior femur with deep perimarginal groove, surface coarsely and densely sculptured. Posterior femur with posterior marginal groove entire, surface shining, sparsely and finely punctured; posterior tibia without accessory spine. Length: 3.7-4.5 mm.

Type.—In the British Museum.

Type locality.—Grenada, British West Indies (here restricted).

Material examined.—Six specimens from Hispaniola, 14 specimens from Puerto Rico, two specimens from Vieques Island, and a single specimen from Trinidad, the last received for study from the British Museum by kindness of Mr. Arrow.

It is possible that *A. tenebrosus* Arrow is a synonym of *A. picipes* Fleutiaux and Sallé, but because of the lack of authentic material of the latter I prefer to list the material before me under the younger but certain name.

11. *ATAENIUS SUBOPACUS*, new species

Piceous, very feebly shining, front of head, anterior margin of pronotum, and legs rather bright castaneous, antennae and trophi pale. Anterior margin of head bluntly angulate each side of the shallow median emargination, front finely, transversely rugulose, vertex highly polished, sparsely and not coarsely punctured, the punctures slightly more dense at sides. Pronotum with marginal setae fine and rather sparsely placed, especially across base, marginal groove entire, posterior angles almost effaced. Surface subopaque, densely and moderately coarsely punctured, the punctures only slightly sparser at anterior portion of disk. Elytral striae fine but rather deep, strial punctures not conspicuous, intervals almost flat, each set with two rows of closely set punctures adjacent to the striae. Each puncture bears a minute seta. Lateral margin rather blunt, epipleura opaque. Pygidial carina with fine and acute cusp, which is continued onto the pygidium as a fine longitudinal carina reaching two-thirds to apical margin. Metasternum somewhat shining, finely and densely sculptured on extreme lateral area, median area somewhat deepened along groove, sparsely and rather coarsely punctured, median groove deep, abruptly terminated anteriorly. Abdominal sternites coarsely punctured, densely at sides, sparsely along median line, basal transverse row of pits on each sternite fine and distinct. Anterior femur with perimarginal groove, surface coarsely, evenly, and moderately densely punctured. Posterior femur without marginal groove, shining, sparsely and finely punctured; posterior tibia without accessory spine. Length: 3.5–4 mm.

Type and paratypes.—U.S.N.M. No. 53323.

Type locality.—Grenada, British West Indies.

Material examined.—Type (male) and one paratype from 3 miles west of Grand Anse, January 20, 1936 (station 150); one paratype from 2 miles west of Grand Anse, January 13, 1936 (station 131); one paratype from 1 mile northeast of Grenville, January 21, 1936 (station 151), all collected by Dr. R. E. Blackwelder. There is also a single specimen of this species from Carriacou of the Grenadines, near Limlair, January 17, 1936 (Blackwelder station 144).

12. *ATAENIUS GRACILIS* (Melshelmer)

- Oxyomus* (*Pleurophorus*) *gracilis* MELSHELMER, 1844, Proc. Acad. Nat. Sci. Philadelphia, new ser., vol. 2, p. 137.
- Psammodytes gracilis* DU VAL, 1857, in de la Sagra, Historia física, política y natural de la isla de Cuba, vol. 7, p. 119.
- Ataenius gracilis* GEMMINGER and HAROLD, 1869, Catalogus coleopterorum, vol. 4, p. 1066.—HORN, 1871, Trans. Amer. Ent. Soc., vol. 3, p. 286; 1887, loc. cit., vol. 14, p. 79.—BATES, 1887, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 99.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodiinae, p. 436.
- Aphodius chilensis* SOLIER, 1851, in Gay, Historia física y política de Chile, Zool., vol. 5, p. 72, pt. 16, fig. 1 (teste Schmidt, 1922).

Piceous-black, somewhat shining, legs castaneous, antennae and trophi pale. Anterior margin of head broadly rounded each side of the very shallow median emargination, front rather coarsely and densely punctured, the punctures tending to form longitudinal rows on upper part and becoming finer and sparser near margin, vertex coarsely and cribrately punctured. Pronotum with marginal setae apparently absent, marginal groove entire, and with a short shallow median longitudinal groove at base. Surface rather coarsely, evenly but not densely punctured, the punctures finer toward anterior margin. Elytral striae moderate, strial punctures large, intervals convex, the first (sutural) interval with a close set series of rather coarse punctures, other intervals more finely and less regularly punctured. Lateral margin subcarinate, epipleura somewhat shining. Pygidial carina with a feeble median cusp, extreme apical portion tumid, surface subopaque. Metasternum with median portion shining, median groove broad and deep, not abruptly terminated anteriorly, each side along base with a deep, oblique antecoxal groove, surface coarsely and sparsely punctured. Abdominal sternites with punctation similar to that of metasternum, basal transverse rows of pits feebly defined. Anterior femur with perimarginal groove, surface sparsely and rather coarsely punctured, posterior femur with short groove on posterior margin near insertion of tibia, surface finely and very sparsely punctured; posterior tibia without accessory spine. Length: 3–3.5 mm.

Type.—Probably in Museum of Comparative Zoology.

Type locality.—Pennsylvania, U. S. A.

Material examined.—In addition to many hundred specimens from Pennsylvania and other localities on continental America, 151 specimens have been studied from the following islands: Cuba, Jamaica, Hispaniola, Puerto Rico, Vieques, St. Croix, St. Kitts, Barbados, and St. Vincent. Arrow, 1903, reports this species from Grenada also.

13. *ATAENIUS ELONGATUS* (Palliot)

Scarabaeus elongatus PALISOT DE BEAUVOIS, 1811, Insectes recueillis en Afrique et en Amérique ..., livr. 7, p. 104, pl. 3c, fig. 8.

Ataenius elongatus FLEUTIAUX and SALLÉ, 1889, Ann. Soc. Ent. France, ser. 6, vol. 9, p. 397 (probably erroneous determination of Guadeloupe specimens).

Piceous to black, extreme anterior margins of head and pronotum, legs, antennae, and trophi castaneous. Anterior margin of head rounded each side of median subangulate emargination, front strongly convex, almost gibbous at middle, very finely and rather densely punctured, vertex a little more coarsely punctured. Pronotum with marginal setae only at sides, marginal groove entire, extreme margin acute. Surface very finely alutaceous, evenly, densely, and uniformly punctured throughout. Elytral striae fine and deep, strial punctures absent, intervals feebly convex, finely alutaceous, very sparsely and minutely punctulate, the punctures tending to form two rows on each interval. Lateral margin subcarinate, epipleura shining but rather roughly sculptured. Pygidial carina with strong median cusp, apical margin thickened. Metasternum shining, median portion slightly elevated, finely and moderately densely punctured, median groove abruptly terminated anteriorly. Abdominal sternites minutely punctured, more coarsely so at sides, basal transverse row of pits on each sternite fine. Anterior femur with perimarginal groove, the surface sparsely and indefinitely punctured. Posterior femur without marginal groove, surface shining and minutely but sparsely punctulate; posterior tibia without accessory spine. Length: 5-5.7 mm.

Type.—Location unknown to the author.

Type locality.—Santo Domingo [Hispaniola].

Material examined.—In all, 43 specimens have been studied, all from Hispaniola. Localities represented are: Haiti—Port-au-Prince, San Michel, Bayeux; Dominican Republic—Santiago, San Francisco Mountains, Barahona, Monte Cristi, and Puerto Plata.

The record of this species from Guadeloupe seems to me doubtful, as Fleutiaux and Sallé comment specifically on the pronotal punctuation of their specimens. These were possibly *A. darlingtoni* Hinton.

14. *ATAENIUS EDWARDSI*, new species

Piceous to black, anterior margins of head and pronotum and legs castaneous, antennae and trophi paler. Anterior margin of head broadly rounded each side of the moderately deep median emargination, front convex, in male finely and rather densely punctulate and finely transversely rugulose near margin; in female much more strongly rugulose nearly to vertex, vertex more coarsely and not densely punctate. Pronotum with marginal setae longer toward

anterior angles, shorter and sparser across base, marginal groove entire. Surface shining, set with punctures of two sizes: Fine punctures more or less evenly distributed over entire surface and coarse ones confined mainly to the lateral and basal areas. These in the female are even coarser than in the male. Elytral striae fine and deep, stria punctures as in *A. darlingtoni*, intervals moderately convex, finely, irregularly, and sparsely punctulate. Lateral margin subcarinate, epipleura shining, with a row of ill-defined punctures close to the outer edge. Pygidial carina with strong median cusp in male, a feeble one in female; further, the male is furnished with a cusp on apical margin opposite to the cusp on the carina, these cusps often connected by a very fine carina. Metasternum shining, median portion elevated and with a patch of setigerous punctures on posterior half, the setae short and inconspicuous, median groove abruptly terminated anteriorly. Abdominal sternites shining, minutely punctulate on median portion, sparsely but much more coarsely punctured laterally, basal transverse row of pits on each sternite fine. Anterior femur with fine perimarginal groove, the surface finely and sparsely punctured. Posterior femur without marginal groove, almost impunctate; posterior tibia without accessory spine. Length: 4-4.5 mm.

Type and paratypes.—U.S.N.M. No. 53324. Paratypes: Museum Comparative Zoology No. 23556.

Type locality.—Near Spanish Town, Jamaica, British West Indies.

Material examined.—Type and 15 paratypes from near Spanish Town, February 2 (station 377); two paratypes from Montego Bay, February 16 (station 407); one paratype each from Kingston, February 6 (station 391), and Black River, February 24 (station 416), all collected by Blackwelder and Chapin, 1937; two paratypes from Kingston, August 27-29, 1934, P. J. Darlington (in collection Museum of Comparative Zoology).

In addition to the type series 70 specimens have been studied from the following islands: Hispaniola, Puerto Rico, St. Croix, Antigua, Dominica, St. Lucia, Barbados, St. Vincent, Carriacou, and Grenada.

Compared with a specimen of *liogaster* from Teapa, Tobasco, Mexico, H. H. Smith, received from the British Museum, the following differences are noted: There is a break in the even curve of the pronotal margin from middle of base to anterior angle in *liogaster*, not present in the West Indian species. In *liogaster* the apical portion (from carina to apex) of the pygidium is about twice as long as in the corresponding sex of *edwardsi*, and the cusps are very much reduced. The median portion of the metasternum of *liogaster* does not appear to carry setigerous punctures and the posterior femur has a distinct groove, similar to that of *A. darlingtoni*. Dedicated to W. H. Edwards, Government entomologist of Jamaica.

15. *ATAENIUS INSULICOLA*, new species

Piceous; head, anterior margin of pronotum, humeri, and underparts castaneous, antennae paler. Anterior margin of head broadly rounded each side of the moderate median emargination, front moderately convex, in male finely and rather sparsely punctured, finely and sparsely rugulose, in female almost the same but with the rugulosity a little stronger, vertex sparsely but slightly more coarsely punctate. Pronotum with marginal setae fine and regular, those across base very short and inconspicuous, marginal groove entire, posterior angles rounded but evident. Surface shining, set with a mixture of coarse and fine punctures, the coarse punctures absent from the anterior area of the disk. Punctuation similar in the sexes. Elytral striae deep, stria punctures rather coarse, intervals moderately convex, finely and irregularly punctulate. Lateral intervals more coarsely punctured and less shining. Lateral margin subcarinate, epipleura dull, rather coarsely sculptured. Pygidial carina with feeble median cusp. Metasternum shining, lateral portions smooth except for a small sculptured area near extreme lateral margin, median portion slightly concave, sparsely but not finely punctured, median groove deep, abruptly terminated anteriorly and posteriorly. Abdominal sternites coarsely sparsely punctured at sides, very sparsely punctured along median line, basal transverse row of pits on each sternite sharply defined. Anterior femur with perimarginal groove, surface rather coarsely punctured. Posterior femur without marginal groove, surface shining, sparsely and finely punctulate; posterior tibia without accessory spine. Length: 4-4.5 mm.

Type.—U.S.N.M. No. 53325.

Type locality.—St. Vincent, British West Indies.

Material examined.—The type (male) and 13 paratypes of both sexes from St. Vincent. Four specimens from Milepost 8½ on Windward Road, February 19, 1936 (station 181), and 10 from a point on the main road 3 miles southeast of Kingstown, February 23, 1936 (station 185), both lots collected by Dr. R. E. Blackwelder.

This species is similar in general appearance to *A. liogaster* Bates but is separated from that species by the less punctate metasternum and the absence of the marginal groove on the posterior femur.

16. *ATAENIUS CRIBRITHORAX* Bates

Ataenius cribrithorax BATES, 1887, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 95.

Piceous to black, head and pronotum with castaneous areas of indefinite extent, legs castaneous, antennae and trophi paler. Anterior margin of head broadly rounded each side of the shallow median

emargination, front moderately convex, in male rather finely and moderately densely punctured, finely and rather sparsely rugulose, in female the rugulosity tends to be coarser and to obscure the punctures, vertex more coarsely punctate. Pronotum with marginal setae inconspicuous, very short across base, slightly longer toward anterior angles, marginal groove entire, posterior angles not completely effaced. Surface shining, set with a mixture of fine and coarse punctures, the latter somewhat concentrated toward the sides. In the female the coarse punctures are even coarser than in the male, and in some specimens those near the anterior angles tend to coalesce. Elytral striae deep, stria punctures rather coarse, intervals moderately convex, finely and irregularly punctulate. Lateral margin subcarinate, epipleura shining, with traces of sculpture. Pygidial carina with a feeble cusp. Metasternum shining, lateral portions coarsely sculptured except for a narrow smooth area before each coxa, the median portion somewhat concave, sparsely and rather finely punctured, median groove deep, rather abruptly terminated anteriorly. Abdominal sternites coarsely but sparsely punctured, the punctures becoming more dense laterally, basal transverse row of pits on each sternite fine. Anterior femur with perimarginal groove, surface coarsely but sparsely punctured. Posterior femur with groove on posterior margin in apical half, surface finely and sparsely punctulate; posterior tibia with accessory spine. Length: 3.8-4 mm.

Type.—In the British Museum.

Type locality.—Mexico to Panama (not definitely restricted).

Material examined.—Two specimens from the type series received some years ago from the British Museum. Other specimens from Central America and 53 specimens from Jamaica and Cuba. There is also a specimen in the collection from St. Thomas, Virgin Islands, which I refer to this species with doubt.

17. *ATAENIUS LIOGASTER* Bates

Ataenius liogaster BATES, 1887, *Biologia Centrali-Americana*, Coleoptera, vol. 2, pt. 2, p. 94.—HINTON, 1937, *Ann. Mag. Nat. Hist.*, ser. 10, vol. 20, p. 193.

Piceous-black, anterior margin of head narrowly and legs castaneous, antennae and trophi pale. Anterior margin of head subangulately rounded each side of the very shallow median emargination, front only slightly convex, finely transversely rugulose anteriorly, very finely and sparsely punctured posteriorly. Vertex more coarsely and rather densely punctured. Pronotum with marginal setae fine, short, and inconspicuous across base, marginal groove entire, posterior angles almost obsolete. Surface shining, set with a mixture of minute and coarse punctures, the coarse punctures more sparsely placed and very

sparse on anterior portion of disk. Elytral striae fine and rather deep, strial punctures coarse and slightly off center, thus crenating the inner edge of each interval, intervals slightly convex and minutely alutaceous, sparsely and irregularly punctulate. Lateral margin subcarinate, epipleura shining. Pygidial carina with feeble median cusp. Metasternum shining, lateral portions finely sculptured near extreme lateral margin, median portion sparsely but not very finely punctured, median groove deep, not abruptly terminated either anteriorly or posteriorly. Abdominal sternites rather coarsely and closely punctured at sides, more sparsely so along median line, basal transverse row of pits on each sternite fine. Anterior femur with perimarginal groove, surface shining, sparsely and finely punctured with a very few very coarse punctures near posterior margin. Posterior femur with groove on posterior margin in apical half, surface very finely and sparsely punctulate; posterior tibia with accessory spine. Length: 4-4.8 mm.

Type.—In the British Museum.

Type locality.—Mexico.

Material examined.—A specimen from Teapa, State of Tabasco, Mexico, determined by Bates and received from the Biologia Centrali-Americana material; a specimen from Habana, Cuba, T. Barbour (in collection of Museum of Comparative Zoology); and a specimen from Grand Terre, Guadeloupe, November 14, 1935 (Blackwelder station 86).

The specimens recorded from Haiti and Santo Domingo by Hinton, 1937, and now in the U. S. National Museum appear to belong to *A. insulicola* rather than this species.

18. *ATAENIUS DARLINGTONI* Hinton

Ataenius darlingtoni HINTON, 1937, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 179, figs. 6-9.

Piceous to black, extreme anterior margins of head and pronotum and legs castaneous, antennae and trophi paler. Anterior margin of head rounded each side of rather deep median emargination, front rather strongly convex, very finely and transversely rugulose with fine punctures replacing the rugulosities near vertex, vertex more coarsely punctured. Pronotum with marginal setae long at sides, short and sparse across base, marginal groove entire. Surface shining, not densely set with punctures of two sizes, fine ones more or less evenly distributed over the entire surface and coarse ones largely concentrated toward the sides. Elytral striae moderately sharp and deep, strial punctures coarse, placed slightly off center in stria so that they tend to encroach on the neighboring interval, intervals feebly convex, shining, very irregularly and finely punctulate. Lateral margin subcarinate, epipleura shining, irregularly and

sparsely sculptured. Pygidial carina with strong median cusp. Metasternum shining, median portion slightly raised, sparsely and very finely punctulate, median groove abruptly terminated both anteriorly and posteriorly. Abdominal sternites coarsely and rather densely punctured at sides, almost free of punctures along middle line of body, basal transverse row of pits on each sternite moderately coarse. Anterior femur with perimarginal groove, surface finely and sparsely punctulate, with a small cluster of coarse punctures near posterior margin near apex. Posterior femur with short groove along posterior margin in apical half, surface sparsely and finely punctulate with a small cluster of coarse punctures near apex; posterior tibia with accessory spine. Length: 4.7–5.5 mm.

Type.—In collection of H. E. Hinton. Paratypes: U.S.N.M. No. 52659.

Type locality.—Puerto Rico: Caratanga [=Cartagena] Lagoon.

Material examined.—Seventy specimens including seven paratypes. The following islands are represented by specimens: Cuba, Jamaica, Hispaniola, Puerto Rico, St. Croix, Antigua, Guadeloupe, and Grenada.

19. ATAENIUS STRIGICAUDA Bates

Ataenius strigicauda BATES, 1887, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 96, pl. 6, fig. 24.—ARROW, 1903, Trans. Ent. Soc. London, p. 511.—FALL, 1930, Journ. New York Ent. Soc., vol. 38, p. 98 (sub *floridanus* Brown).

Piceous-black, moderately shining, legs deep castaneous, antennae and trophi paler. Anterior margin of head broadly rounded on each side of the shallow median emargination. Front very finely, transversely strigillose, upper part (up to line connecting anterior margin of eyes) finely and rather densely punctured, vertex (beyond eye line) much more coarsely punctured. On occasional specimens some coarse punctures are found anterior to this line. Pronotum with marginal setae regularly set along sides and across base, marginal groove complete, a little widened toward anterior angles. Surface nearly smooth to very finely alutaceous and with punctures of two sizes: coarse punctures very densely placed laterally becoming very sparse on disk and fine punctures more or less evenly distributed between the coarser punctures over the entire surface. Elytral striae rather deep and fine, with strong indications of stria punctures, intervals sub-convex, becoming more acute near apex, surface nearly smooth to finely alutaceous and each interval with two moderately well defined rows of fine punctures except that the outer three intervals are more coarsely and irregularly sculptured. Lateral margin cariniform, subacute, epipleura rather shining. Pygidial carina with a feeble median cusp. Mesosternum strongly shagreened, intercoxal carina

broad and moderately long. Metasternum polished, very finely and very sparsely punctured, median groove not abruptly terminated anteriorly. On each side of median line and just behind the middle coxae there is a cluster of two or more very coarse punctures. Abdominal sternites coarsely punctured, the punctures somewhat finer and sparser at the middle. Transverse basal rows of pits quite poorly defined. Anterior femur beneath with deep perimarginal groove, the surface densely and rather coarsely punctured. Posterior femur with groove on hind margin reaching from tibial joint two-thirds (male) or half (female) distance to trochanter; posterior tibia with accessory spine. Length: 4.5–6 mm.

Type.—In the British Museum.

Type locality.—Cordoba, [Veracruz] Mexico (restricted here).

Material examined.—Eighty-four specimens from the West Indian Islands, in addition to many specimens from Florida, Mexico, Honduras, Panama, Canal Zone, Bolivia, and Argentina. Based on specimens before the writer the species is known to occur on the following islands: Cuba, Bahamas, Jamaica, Hispaniola, Puerto Rico, St. Croix, Guadeloupe, Dominica, St. Lucia, Barbados, St. Vincent, and Trinidad. Arrow (1903) reports it also from Grenada and Bequia Island.

The degree of alutaceousness of the elytral intervals and the strength of the punctures on the head appear to be variable without reference to geography. Further, each of the two characters varies without reference to the other. The small patch of coarse punctures on each side of the metasternum seems to be the surest differential to separate this species from the other large *Ataenius*.

20. *ATAENIUS FRATER* Arrow

Ataenius frater ARROW, 1903, Trans. Ent. Soc. London, p. 512.

Piceous-black, shining, appendages paler. Anterior margin of head strongly rounded on each side of the median emargination, front densely punctured, the punctures very fine toward the margin at middle, gradually becoming coarser posteriorly and laterally, vertex narrowly impunctate. Pronotum with marginal setae very short and inconspicuous, most evident just before the scutellum, submarginal groove narrow across base, widening toward anterior angles. Surface polished, punctures coarse and quite dense at sides, rather fine and sparse on disk. Elytral intervals flat, becoming subconvex apically. Basally the intervals are smooth and polished with fine and sparse punctures on disk and coarser and denser punctures laterally. Apically the polished portion of each interval becomes gradually narrower until at the extreme apex the intervals are strongly alutaceous with median rows of microscopic polished raised points.

The tenth interval (submarginal) is alutaceous throughout its length. The lateral margin is cariniform and very prominent; the epipleura alutaceous and complete. Pygidial carina with strong median cusp. Mesosternum strongly shagreened, clothed with short hair, with a short low carina between the coxae. Metasternum polished at middle, roughened by dense punctation at sides, median groove abruptly terminated before and behind, polished area sparsely and irregularly punctured. Abdominal sternites coarsely and closely punctured, with transverse basal rows of contiguous pits. Anterior femur beneath with deep perimarginal groove, anterior tibia tridentate, the basal tooth less acute than either of the others. Posterior femur with groove on hind margin, which is complete in male and which reaches from the tibial joint three-fourths of the distance to trochanter in female; posterior tibia with accessory spine. Length: 4-5 mm.

Type.—In the British Museum.

Type locality.—St. Vincent (south end), British West Indies.

Material examined.—Two hundred and thirty-four specimens from the West Indies have been studied. The species is widely distributed in the islands and eventually may be found on all islands. Specimens have actually been seen and studied from the following islands: Bahamas, Jamaica, Hispaniola, Puerto Rico, St. Thomas, Tortola, St. Croix, St. Kitts, Antigua, Montserrat, Guadeloupe, Dominica, Barbados, St. Vincent, Grenada, and Trinidad.

21. *ATAENIUS JAMAICENSIS*, new species

Dark castaneous to piceous, with vertex, pronotum except extreme margins, scutellum, and first to fifth and seventh elytral interspaces in part darker. Anterior margin of head subhemi-hexagonal, slightly depressed at middle, the angles rounded, front rather coarsely asperate, the asperities tending to form transverse ridges at middle, interocular area finely and not densely punctured, vertex polished, without visible punctures. Pronotum with marginal setae becoming very short across base, marginal groove narrow before the scutellum and progressively widening to its termination at the anterior angles. Surface polished at disk, with a fine scalelike ground sculpture at sides, rather coarsely and densely punctured, the punctures finer and sparser along median line which is sometimes devoid of punctures. Scutellum and elytra with scalelike ground sculpture, the former devoid of punctures, the latter with a coarse seriate punctation. Intervals somewhat convex, with a few scattered fine punctures, each of which bears a minute seta. Epipleura entire to apices of elytra, coarsely and irregularly wrinkled. Transverse carina of pygidium with triangular median cusp, margin polished, area bounded by margins and transverse carina with very

dense and fine scalelike sculpture. Mesosternum strongly shagreened, with dense vestiture of short hairs. Metasternum at middle polished, distinctly punctured, with a deep narrow median groove which ends abruptly both anteriorly and posteriorly, the area adjacent to the middle coxae shagreened and hairy, posteriorly and adjacent to hind coxae, very sparsely punctured and with a scalelike ground sculpture. Abdominal sternites coarsely and sparsely punctured, each with a transverse row of coarse contiguous pits in basal portion. Anterior femur beneath with deep perimarginal groove, anterior tibia with three subequal acute teeth. Posterior femur without groove on hind margin; posterior tibia with accessory spine. Length: 4 mm.

Type and paratypes.—U.S.N.M. No. 53326.

Type locality.—Black River, Jamaica.

Material examined.—Twenty-five specimens from Jamaica as follows: 17 specimens from type locality, February 24, 1937 (Chapin and Blackwelder station 377); one specimen from Spanish Town, February 2, 1937 (Chapin and Blackwelder station 420); three specimens from near Gutters, February 25, 1937 (Chapin and Blackwelder station 422); four specimens from near May Pen, February 26, 1937 (Chapin and Blackwelder station 425).

This species and *Ataenius nigrolineatus* Hinton from Panama are, so far as the writer knows, the only described species of the genus in which the elytra are distinctly vittate. *A. nigrolineatus* is a much more robust species and, further, is separated from *A. jamaicensis* by the uniform dense punctuation of the pronotum and by the very smooth front of the head.

22. ATAENIUS ACICULUS Hinton

Ataenius aciculus HINTON, 1937, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 187.

Light piceous, head, flanks of pronotum, and elytra and legs reddish brown, antennae and trophi paler. Anterior margin of head subangulate each side of the rather deep and broad median emargination, genal lobes angulate and prominent. Front very finely punctured on upper part, finely and transversely rugulose below, vertex coarsely and not densely punctured. Pronotum with marginal setae rather long and conspicuous, marginal groove fine across base, becoming feeble toward anterior angles. Surface feebly shining, disk with a few coarse punctures interspersed among the very fine punctures, laterally the coarse punctures become dense and subconfluent. Elytral striae fine and deep, strial punctures moderately coarse, intervals evenly convex, strongly alutaceous, sparsely, irregularly and rather finely punctured. Lateral margin blunt, epipleura opaque, irregularly sculptured. Apical declivity and flanks sparsely set with moderately long setae. Pygidial carina with a strong median cusp.

Metasternum opaque and finely sculptured at sides, shining and very coarsely punctured on median area, median groove moderately deep, abruptly terminated anteriorly. Abdominal sternites sparsely and rather finely punctured, basal transverse rows of pits poorly defined. Anterior femur with deep perimarginal groove, surface coarsely and densely punctured. Middle femur with posterior marginal groove. Posterior femur without marginal groove, surface shining, coarsely and sparsely punctured, the punctures almost entirely in apical half; posterior tibia with accessory spine. Length: 3.7 mm. (given as 4 mm. by Hinton).

Type.—U.S.N.M. No. 53327.

Type locality.—Diquini, Haiti.

Material examined.—A single specimen, the type, which was collected at the above locality by J. B. Torres.

A species notable for the fact that the middle and hind femora are quite different. It is the rule in *Ataenius* that these femora are similar.

23. *ATAENIUS VERSICOLOR* Schmidt

Ataenius versicolor SCHMIDT, 1916, Arch. Naturg., vol. 82A, Heft 1, p. 105.—

HINTON, 1937, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 183 (part).

Ataenius haitianus HINTON, 1937, loc. cit. p. 184.

Piceous, sides of pronotum, outer intervals and apical third of elytra, antennae, and trophi pale reddish to yellowish brown, somewhat shining. Anterior margin of head broadly rounded each side of the moderately deep median emargination, front finely and irregularly rugulose with numerous fine punctures intermingled, vertex much more coarsely and rather densely punctured. Pronotum with marginal row of setae complete, the setae near the anterior angles longer, marginal groove complete and coarse. Surface closely and at sides cribrately punctured, the punctures of two sizes—very coarse, which are quite sparse on disk, and moderately fine, which are evenly though rather sparsely distributed over the entire pronotum except where the coarse punctures coalesce. Elytral striae deep, striae punctures moderately coarse, intervals convex but not at all carinate, each interval with two or three irregular rows of minute punctures, apical portions of all intervals and entire outer two intervals with fine setae, surface not strongly alutaceous. Lateral margin subcarinate, setose, epipleura somewhat shining. Pygidial carina with strong median cusp. Mesosternum finely sculptured, metasternum shining, laterally with a small patch of punctures near the epimeron, median portion flattened, finely and rather sparsely punctured, median groove deep, abruptly terminated anteriorly and posteriorly. Abdominal sternites coarsely and rather densely punctured, transverse basal row of pits on last sternite coarse and deep. Anterior

femur with perimarginal groove, surface very coarsely and densely punctured. Posterior femur slender, shining, sparsely and finely punctured, without marginal groove; posterior tibia without accessory spine. Length: 3.5-4.2 mm.

Type.—Of *versicolor* in collection Schmidt; of *haitianus*, U.S.N.M. No. 53892.

Type locality.—Haiti, Hispaniola.

Material examined.—Eighteen specimens from Haiti, six from Dominican Republic, and one from Point Cangrejos, Puerto Rico, April 6, 1920, G. N. Wolcott. There is an additional specimen from 15 miles northeast of Port-au-Prince, Haiti, August 26, 1935 (Blackwelder station 30) that appears to be an abnormal individual of this species. It is but 3.2 mm. in length and is less densely punctured than usual.

24. *ATAENIUS LUTEOMARGO*, new species

Aphodius marginellus CHEVROLAT, 1864, Ann. Soc. Ent. France, ser. 4, vol. 4, p. 414 (not Fabricius).

Ataenius terminalis ARROW, 1903, Trans. Ent. Soc. London, p. 512 (not Chevrolat).

Ataenius versicolor HINTON, 1937, Ann. Mag. Nat. Hist., ser. 10, vol. 20, p. 183. (Hinton's specimens from Dominica and Jamaica now in U. S. National Museum, not Schmidt).

Piceous, margins of head and pronotum indefinitely paler, outer two intervals and apices of elytra yellowish to brownish yellow, pygidium and tibiae castaneous, antennae and trophi paler. Anterior margin broadly rounded (subangulate in fresh specimens) on each side of the very shallow median emargination, front minutely punctulate, otherwise smooth in male or finely transversely rugulose in female, vertex anteriorly with a narrow band of coarse punctures extending between eyes, posteriorly impunctate and shining. Pronotum with marginal setae sparse and irregularly placed, marginal groove complete but fine across base. Surface very finely alutaceous, in male minutely and rather sparsely punctulate with sparse coarse punctures laterally and across the base, in female, similar but with coarse punctures more densely placed. Elytral striae very fine, strial punctures hardly visible, intervals feebly convex, each interval rather strongly alutaceous and set with two rows of very fine punctures. Lateral margin carinate except at apex where it is bluntly rounded. The upper face of the carina carries a series of coarse punctures. Epipleura shining. Pygidial carina with strong median cusp, pygidial apex thickened. Mesosternum finely sculptured, strongly pubescent, metasternum shining, minutely and sparsely punctulate, median groove abruptly terminated anteriorly, evanescent posteriorly. Abdominal sternites coarsely but indefinitely

punctured laterally, first sternite rather densely pubescent. Sternites separated by rows of fine impressed pits. Anterior femur with perimarginal groove, its surface sparsely but rather coarsely punctured. Posterior femur without marginal groove, surface almost impunctate; posterior tibia without accessory spine. Length: 4-4.5 mm.

Type.—U.S.N.M. No. 53328.

Type locality.—Dominica, British West Indies.

Material examined.—Type and 370 paratypes from Dominica, taken mostly near Roseau, whence the type comes. Besides the type series the writer has examined 1,714 specimens from the following islands: Jamaica, Hispaniola, Puerto Rico, St. Kitts, Antigua, Montserrat, Guadeloupe, St. Lucia, Barbados, and Grenada. The absence of this species from St. Vincent has already been commented on by Arrow (sub *terminalis*). On the islands where it occurs it appears to be by far the most common *Ataenius*.

25. *ATAENIUS SULCATULUS* (Chevrolat)

Aupertia sulcatula CHEVROLAT, 1864, Ann. Soc. Ent. France, ser. 4, vol. 4, p. 413.
Ataenius sulcatulus GEMMINGER and HAROLD, 1869, Catalogus coleopterorum, vol. 4, p. 1067.

? *Aupertia rhyticephala* CHEVROLAT, 1864, loc. cit., p. 413.

Piceous to black, pronotum sometimes pale near anterior angles as are the antennae and tarsi. Anterior margin of head broadly rounded each side of broad and shallow median emargination, head notably wide across genae and not strongly convex, front in male very finely and not at all densely punctured, in female finely transversely rugulose, vertex somewhat more coarsely punctured on area between eyes. Pronotum with rather long and conspicuous marginal setae, marginal groove rather coarse at sides, fine but complete across base. Surface in male very finely and sparsely punctulate, in female more coarsely so, laterally and across base with a very few scattered coarse punctures. Elytral striae deep, strial punctures fine and not conspicuous, intervals convex and smooth, minutely alutaceous, without visible punctation. Lateral margin subacutely carinate, epipleura somewhat shining. Pygidial carina with a strong median cusp; extreme apical margin with median cusp, the two cusps sometimes connected by a very fine carina. Mesosternum rough, metasternum smooth, median portion slightly elevated, in male punctate with short bristlelike setae arising from the punctures, in female similar but without setae, median groove deep but not abruptly terminated. Abdominal sternites impunctate but strongly alutaceous, basal transverse rows of pits not conspicuous. Anterior femur with a very fine perimarginal groove, the surface shining and free of punctures. Posterior femur without marginal groove, also shining and free of punctures; posterior tibia without accessory spine. Length: 3.5-4.5 mm.

Type.—Location unknown to writer.

Type locality.—Cuba.

Material examined.—Thirty-six males and 22 females from Baragua, Bahia Honda, Santiago de las Vegas, and Cayamas, Cuba. Most of the specimens (34 males and 20 females) were collected at Baragua, May 1932, by L. D. Christenson at the laboratory of the Cuban Sugar Club, and I feel that there is no question of the association of the sexes. It is probable that a female of this species served as type of *Auperia rhyticephala* Chevrolat, but the fact is not established.

26. ATAENIUS TERMINALIS (Chevrolat)

Auperia terminalis CHEVROLAT, 1864, Ann. Soc. Ent. France, ser. 4, vol. 4, p. 414.
Ataenius terminalis GEMMINGE and HAROLD, 1869, Catalogus coleopterorum, vol. 4, p. 1067.—SCHMIDT, 1922, Das Tierreich, pars 45, Aphodinae, p. 438.
A[uparia] ciliata CHEVROLAT, 1864, loc. cit., p. 414.

Piceous, apex and sides of elytra in apical half, tibiae, tarsi, antennae, and trophi paler (entirely castaneous in *A. ciliata* Chevrolat). Anterior margin of head broadly rounded each side of the very shallow median emargination, front finely and rather sparsely punctulate, otherwise smooth in male, distinctly transversely rugulose in female, vertex more coarsely punctured and more shining. Pronotum with row of marginal setae broken for a short distance each side of scutellum, marginal groove complete but rather fine across base. Surface finely alutaceous, with a mixture of coarse and fine punctures, the coarse punctures rather sparse in male, much more evident in female. Elytral striae fine but sharply defined, striae punctures fine, close set, intervals very feebly convex, almost flat, each interval rather strongly alutaceous without visible punctures except under high magnification. Lateral margin subcarinate in basal half, rounded toward apex, epipleura shining, with single row of fine punctures in apical third. Pygidial carina with a sharp median cusp, pygidial apex thickened. Mesosternum finely sculptured, pubescent, metasternum shining, its median area sparsely and finely punctured, median groove poorly defined posteriorly but abruptly terminated anteriorly. Abdominal sternites sparsely and indistinctly punctured, especially so in male, first sternite finely and rather densely pubescent. Sternites separated by fine transverse grooves which replace the usual row of pits. Anterior femur without marginal groove, surface very sparsely punctured. Posterior femur very minutely and sparsely punctured, without marginal groove; posterior tibia without accessory spine. Length: 3.6–4 mm.

Type.—Probably in collection of Felsche.

Type locality.—Cuba.

Material examined.—Three hundred and eighty specimens, of which 367 are from various localities on Cuba and 13 from localities on the western half of Jamaica. No specimens have been seen from any other of the West Indian Islands or from the mainland. References to this species in the literature from localities other than Cuba and Jamaica probably refer to *A. luteomargo*.

Except for the difference in coloration, there seems no means of separating the castaneous specimens from the darker ones, and because there are so many intergrading specimens in any large series it has seemed best to list *A. ciliata* (Chevrolat) as a synonym.

27. *ATAENIUS BREVINOTUS*, new species

Dark castaneous, head, sides of pronotum, humeri, and legs light castaneous, antennae and trophi paler. Anterior margin of head broadly rounded each side of the median reflexed emargination, genal lobes rounded. Front and vertex finely and moderately densely punctured, the punctures becoming finer toward the margin. Pronotum strongly transverse, anterior angles broadly rounded and somewhat produced anteriorly, posterior angles strongly indicated, obtuse, marginal setae absent, marginal groove obsolete, feebly indicated across base. Surface very coarsely and rather densely punctured at sides, the punctures becoming finer and sparser on disk where they are of two sizes. Elytral striae fine and sharply defined, strial punctures distinct but not conspicuous, intervals almost flat, minutely alutaceous, set with a few very fine punctures. Lateral margin subacute, epipleura irregularly rugose. Humeral angle raised in a sharp vertical carina. Pygidial carina with an acute median cusp which is prolonged to the apex of the sclerite in a fine carina. Metasternum rough laterally, median area polished, finely and sparsely punctured, median groove shallow, ending anteriorly and posteriorly in pits. Abdominal sternites smooth at middle, roughly punctured at sides, basal transverse rows of pits poorly defined. Anterior femur not quite twice as long as broad, almost rectangular, marginal groove very fine but entire, surface finely and densely sculptured. Posterior femur very slender, posterior marginal groove entire, surface sparsely and moderately finely punctured. Length: 5 mm.

Type.—Museum of Comparative Zoology No. 23554.

Type locality.—Baragua, Cuba.

Material examined.—A single specimen collected May 7, 1926, at light by C. F. Stahl (T.P.R.F. Ent. No. 457).

This most interesting species is apparently an intermediate between the typical *Ataenius* and typical *Eupariis*. In habitus and in the short pronotum, broad anterior femur, and slender posterior femur, the species bears a striking resemblance to *E. costaricensis* Hinton.

But in the structure of the mesosternum and mesocoxae, which points seem to be the most trenchant in separating *Euparixia* from *Ataenius*, it is a typical *Ataenius*.

Genus EUPARIXIA Brown, 1927

Euparixia BROWN, 1927, Can. Ent., vol. 59, p. 288.—HINTON, 1934, Pan-Pac. Ent., vol. 10, p. 27; 1936, Univ. California Publ. Ent., vol. 6, p. 274.

Type of genus: *Euparixia duncani* Brown, 1927 (by monotypy).

This genus was established to contain species of Aphodiinae having the prothorax strongly constricted at base, the middle coxa obliquely truncate at outer extremity where it is contiguous with or overlapped by the elytral margin, and the anterior femur unusually short and broad.

Since the publication of the original diagnosis, two species, *E. formica* and *E. costaricensis*, have been added by Hinton, and in this paper a fourth is described. One of these is known to be associated with ants of the genus *Atta*, and it is probable that such is the habit of all the species. At least it is noteworthy that the known range of *Euparixia* is included within the range of *Atta*.

1. EUPARIXIA BRUNERI, new species

Body uniformly castaneous, legs somewhat darker. Anterior margin of head truncate across middle, sides feebly curved to the prominent genal lobes. Front finely and rather densely punctured in upper portion, finely granulated near margin, central area smooth and slightly raised. Vertex coarsely and very densely punctured. Pronotum broader than long, without well-defined marginal groove, much narrower across base than width of elytra across humeri, posterior angles completely obliterated, greatest width at about anterior third, in front of which point the sides are broadly explanate, anterior angles prominent but broadly rounded. Surface in basal half very coarsely and rather densely pitted, anterior half across disk coarsely to finely punctate, explanate margins almost impunctate. Elytra together suboval, widest across apical third, basal ends of lateral cariniform margin ending in a prominent spur, scutellum elongate triangular, very narrow, striae shallow, strial punctures coarse and quadrate, intervals acutely carinate. Lateral margin acute, epipleura nearly smooth. Pygidial carina feeble with very weak median cusp. Metasternum mostly smooth, median area with a few coarse ill-defined punctures adjacent to middle coxae, median groove shallow. Abdominal sternites with a few very large, shallow, ill-defined pits, the pits of the basal transverse rows very large, quadrate and contiguous. Anterior femur short and very broad, anterior margin with broad groove, surface moderately coarsely and

closely punctured. Anterior trochanters triangular, very prominent. Posterior femur slender, with short posterior marginal groove in apical two-fifths, surface finely and rather sparsely punctured. Length: 4.5 mm.

Type and paratypes.—U.S.N.M. No. 53329.

Type locality.—Baragua, Camaguey, Cuba.

Material examined.—Three specimens from Cuba, two of which were taken at the type locality May 24, 1932, by L. D. Christenson, the third at Santiago de las Vegas, July 20, 1924, and submitted for study by S. C. Bruner.

This species bears a striking resemblance to *E. formica* Hinton but differs from that species as follows: The explanate margins of the pronotum end abruptly at the widest point and are not continued posteriorly in such a way as to be visible from above; the median portion of the metasternum is almost impunctate and not evenly and densely punctate; the posterior marginal groove of the posterior femur is definitely less than half as long as the femur instead of fully half its length.

ADDENDA

Since the preparation of the taxonomic portion of this paper was completed, a few descriptions of Cuban *Ataenius* by Dr. V. Balthasar¹ have come to my attention. It appears that Dr. Balthasar has not access to the recent literature dealing with this group and has perhaps redescribed certain already known species.

The species described by Dr. Balthasar are as follows:

Ataenius waltherhorni BALTHASAR, 1938, loc. cit., p. 55.

I find it impossible to separate this from *A. darlingtoni* Hinton, 1937, a species commonly found on Cuba and elsewhere.

Ataenius havanensis BALTHASAR, 1938, loc. cit., p. 56.

The species appears to me inseparable from *A. miamii* Cartwright, 1934. Up to the present I have not examined specimens of this species from Cuba but have established its distribution in the West Indies as sufficiently wide to make its presence on the island extremely probable. The Florida specimens are almost certainly recent arrivals from some West Indian island.

Ataenius frankenbergeri BALTHASAR, 1938, loc. cit., p. 56.

This is the species that I have here considered to be *A. sulcatulus* (Chevrolat). While the identification is not fully established, sufficient variation in the series from Baragua was noticed to make such an identification highly probable.

¹ Arbeit. Morph. und Taxon. Ent. Berlin-Dahlem, vol. 5, No. 1, pp. 55-61, 1938.



issued by the
SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1940

No. 3093

TWO NEW ANURAN AMPHIBIANS FROM MEXICO

By EDWARD H. TAYLOR

THE two species of frogs described herein are a part of the collection made by Dr. Hobart M. Smith in Mexico during 1938 and 1939 for the United States National Museum. These novelties were called to my attention by Dr. Smith, who requested that I describe the forms. The drawings of the types were made by Walter Yost; those of the tadpole of the *Hyla* by Hazel Watson.

Genus SYRRHOPHUS Cope

SYRRHOPHUS SMITHI, new species

PLATE 1

Type.—U.S.N.M. No. 108594; 15 miles west of Galeana, Nuevo León, Mexico; elevation 5,200 feet, October 13, 1939. H. M. Smith collector.

Paratype.—EHT-HMS No. 23067, topotype.

Diagnosis.—A large member of the genus (known maximum size 33 mm.); width of an eyelid nearly four-fifths the interorbital distance; diameter of eye equals its distance from anterior edge of nostril; a long (6.2 mm.) lumbar gland scarcely discernible except for pores seen under lens; diameter of tympanum a little more than half of eye diameter; tibiotarsal articulation reaches to tympanum; heels touch but do not overlap; tip of digits somewhat thickened, blunt, lacking a terminal groove, not wider than digits; an outer palmar tubercle present; dorsal and ventral surfaces absolutely smooth; a few granules on anterior part of sides; ash gray with black flecking above; white below.

Description of the type.—Head a little narrower than body, its width (11.2 mm.) about equal to its length (11.25 mm.); canthal region rounding, the lores sloping broadly to lip, the region behind nostril slightly concave; snout oval, the tip broadly rounded; eye length (4 mm.) less than length of snout (5.1 mm.), reaching anterior edge of nostril; nostril small, contained in distance to eye four times; tympanum subcircular, slightly higher than long, its diameter (2.3 mm.) more than one-half of the eye (4 mm.), separated from eye by a distance equal to more than half its diameter (1.2 mm.).

Tongue rather thick, somewhat pyriform, not or but slightly nicked behind, free for about half its length, somewhat papillate; choanae large, nearly lateral, not concealed by jaw when seen from below; no vomerine teeth.

Arm moderately long, when extended the wrist reaches beyond snout; first finger as long as second, both shorter than fourth; three palmar tubercles, outer small, conical, median largest, oval, inner as large as subarticular tubercles; slight swellings under the distal joints; supernumerary tubercles large; five supernumerary tubercles on palm, and some smaller granules at base of fingers; leg rather short; the heel reaches to tympanum, the inner metatarsal tubercle does not quite reach tip of snout; small inner metatarsal tubercle, only little larger than subarticular tubercles; outer metatarsal tubercle a little more than half as large as inner; subarticular tubercles large, very salient, the tips pointed forward; supernumerary tubercles present; those on the third and fourth toes high, compressed; about 13 tubercles of varying size on sole; free part of fourth toe twice that of the fifth; no trace of tarsal folds or tubercles. No trace of web.

Skin above, quite smooth; below, likewise smooth; a few granules evident on sides, encroaching slightly on abdomen; an abdominal disk faintly discernible, the posterior edge of which crosses posterior part of abdomen some distance in front of femurs; lumbar gland (discernible only by the enlarged pores visible under a lens or by the cream-white exudate) about 6.2 mm. long, and about one-third as wide; it does not reach groin; vocal sacs in male ?; slight suggestion of flattened tubercles on eyelid. Under side of femur with longitudinal grooves, between which there is some granulation; granulation on posterior face of femur more distinct.

Color, freshly preserved.—Ash gray with numerous indefinite darker gray, blackish, or brownish flecks; a larger blackish-brown spot on the gland, with some minute light flecks; limbs lighter than body, with indefinite brownish bars on femur, more pronounced bars on tibia; feet dimly barred; a tiny light spot between orbits, tympanum brownish; a darker loreal stripe; edge of lip much lighter than lores; entire ventral surfaces white with a very sparse peppering of darker (visible only under the lens).

Measurements (in mm.).—Snout to vent, 33; snout to angle of mouth, 7.6; snout, 5.1; eye diameter, 4; tympanum, 2.3; head width, 11.2; head length, 11.25; arm, 20.2; leg, 45; tibia, 14; foot, 21.

Remarks.—The paratype is a very young specimen having the mode of coloration somewhat different. The general coloration is blackish brown, with the minute grayish-white flecks a little more prominent on the sides. A row of white flecks is present along edges of lips, while the light flecks and spots on the arms are more pronounced, the light predominating. On the limbs the whitish-cream coloration covers most of the anterior face of the femur and a region on the dorsal surface of the femurs. The banding is not pronounced on the postero-dorsal face of femur and tibia. Numerous small cream spots are present on chin, breast, and abdomen, with a fine peppering of dark pigment.

This species appears to be most closely related to the very much smaller *Syrrhophus guttilatus* (Cope) (type locality, Guanajuato). It differs apparently in having shorter legs and longer arms and a totally different coloration (that species being brown with whitish spots, the limbs banded with rufous).

The specimens were collected 15 miles west of Galeana; elevation 5,200 feet. They were found in semiarid terrain, under a rock. The vegetation is of low shrub, cactus, and agaves; no grass cover is present in the type locality.

The species is named for its discoverer, Dr. Hobart M. Smith.

Genus *HYLA* Laurenti

HYLA DENDROSCARTA, new species

PLATES 2, 3

Type.—U.S.N.M. No. 108679 collected at Cuautlapa, Veracruz, January 1, 1939, by Dr. Hobart M. Smith.

Paratypes.—U.S.N.M. Nos. 108676–108678; 108680–108686. EHT–HMS Nos. 23236–23256, all topotypes.

Diagnosis.—A medium-sized tree frog (known maximum size 35 mm., snout to vent); fingers about one-third, toes about two-thirds, webbed; tympanum moderately distinct, covered with skin pigmented like the body, about half the diameter of the eye; tibiotarsal articulation reaches nostril; subarticular tubercle of outer finger bifid; small vocal sacs in males; vomerine teeth between choanae; gums at the base of the teeth and between the teeth heavily pigmented; tongue not free behind.

Description of the type.—Head rather large, a little broader than the body; eye moderate, its diameter (3.6 mm.) much less than length of snout (4.5 mm.); width of upper eyelid (3.4 mm.) much less than

interorbital distance (4.4 mm.); diameter of tympanum (1.9 mm.) slightly larger than half diameter of orbit (3.6 mm.); canthus rostralis rounded; loreal region slightly concave behind nostril; snout rather pointed, the nostrils about 1 mm. from the tip.

Tongue subcircular, not or but slightly notched behind, the posterior part of tongue not free; choanae rather large; vomerine teeth in two groups lying between choanae but not reaching their anterior or posterior levels, the two groups of teeth separated from each other by a distance as great as their distance from choanae; gums about teeth pigmented, the pigment appearing to form short vertical lines between the teeth; the openings of the mucous glands form a continuous sinuous line about halfway between the anterior level of choanae and the front of mouth.

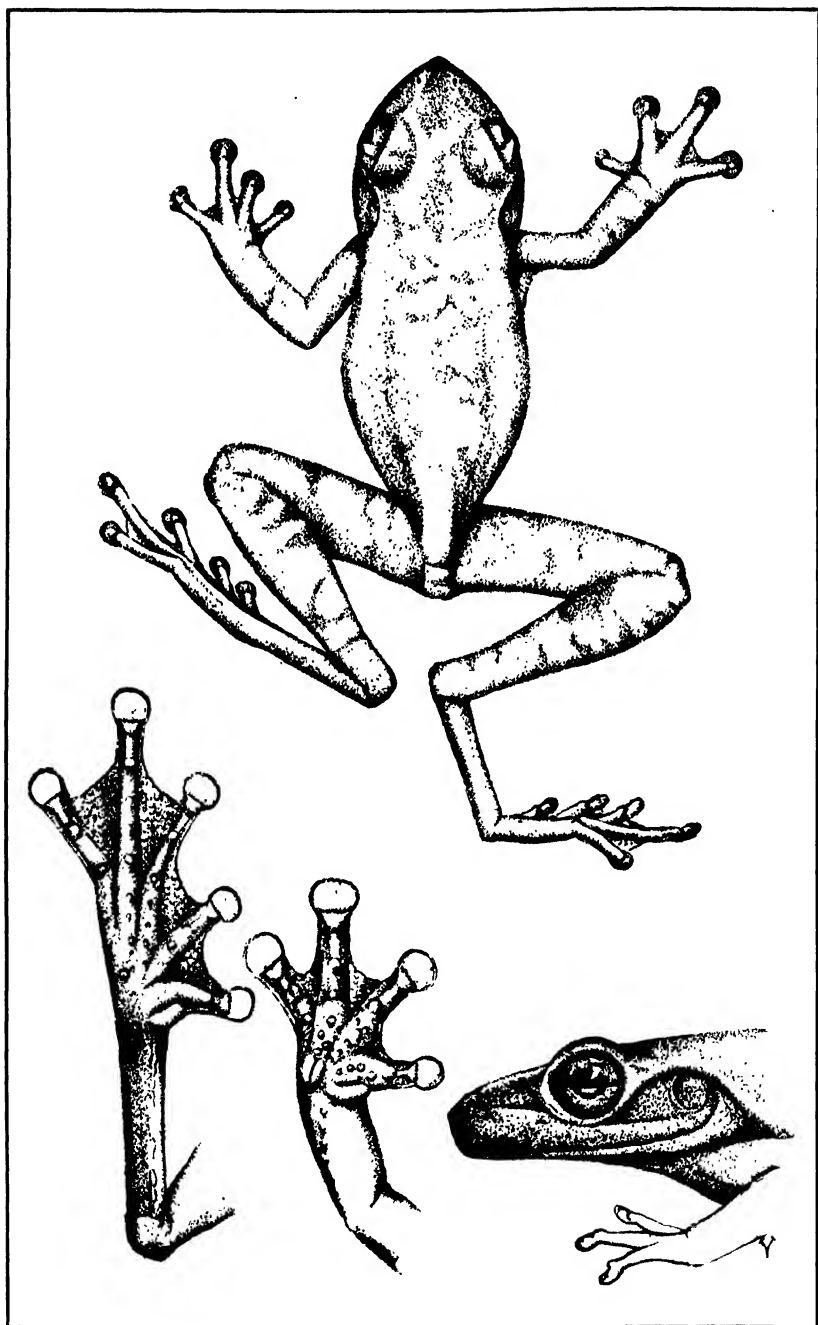
Hand brought forward the wrist reaches beyond tip of snout; fingers a little more than one-third webbed, the edges of the membrane more or less scalloped and continuing as a very narrow fringe to base of disks; terminal disks large, those of outer fingers (2 mm.) with a diameter greater than tympanum; subarticular tubercle of the fourth finger bifid; that on first finger larger than those on second and third; large elongate tubercle at base of first finger, larger than the palmar tubercle, which is more or less bifid; numerous smaller tubercles on palm, the skin between them more or less granular; a row of five tubercles under forearm; tibiotarsal articulation reaches to posterior edge of nostril; tarsal fold present, not especially well developed; third and fifth toes reach forward the same distance; toes little more than two-thirds webbed, the webs more or less scalloped on the edges and reaching forward to the disks as narrow margins; inner metatarsal tubercle large, flattened; outer small, farther forward than the anterior edge of the inner tubercle; several supernumerary tubercles on sole, the skin between them and the membrane between toes granular; terminal disks well developed but a little smaller than the disks of outer fingers; when limbs are placed at right angles to body the heels overlap (5 mm.); anal flap rather small; anus followed by a short narrow groove and radiating fluting.

Skin of head minutely corrugated, of body practically smooth; chin and throat faintly granulate; breast, abdomen, under side of femur, and a slight area on the posterior face of femur with heavy granulation; a small tubercle on heel.

Color in alcohol.—Above, fawn color, with faint lavender coloration on head and some indefinite mottling on the back and limbs of the same color; below, uniform creamy white; under a lens the pigment is visible as minute dots; it is present on the ventral surface as a slight peppering, on anterior edge of lower jaw, and on under side of knee and foot; otherwise the venter is immaculate.

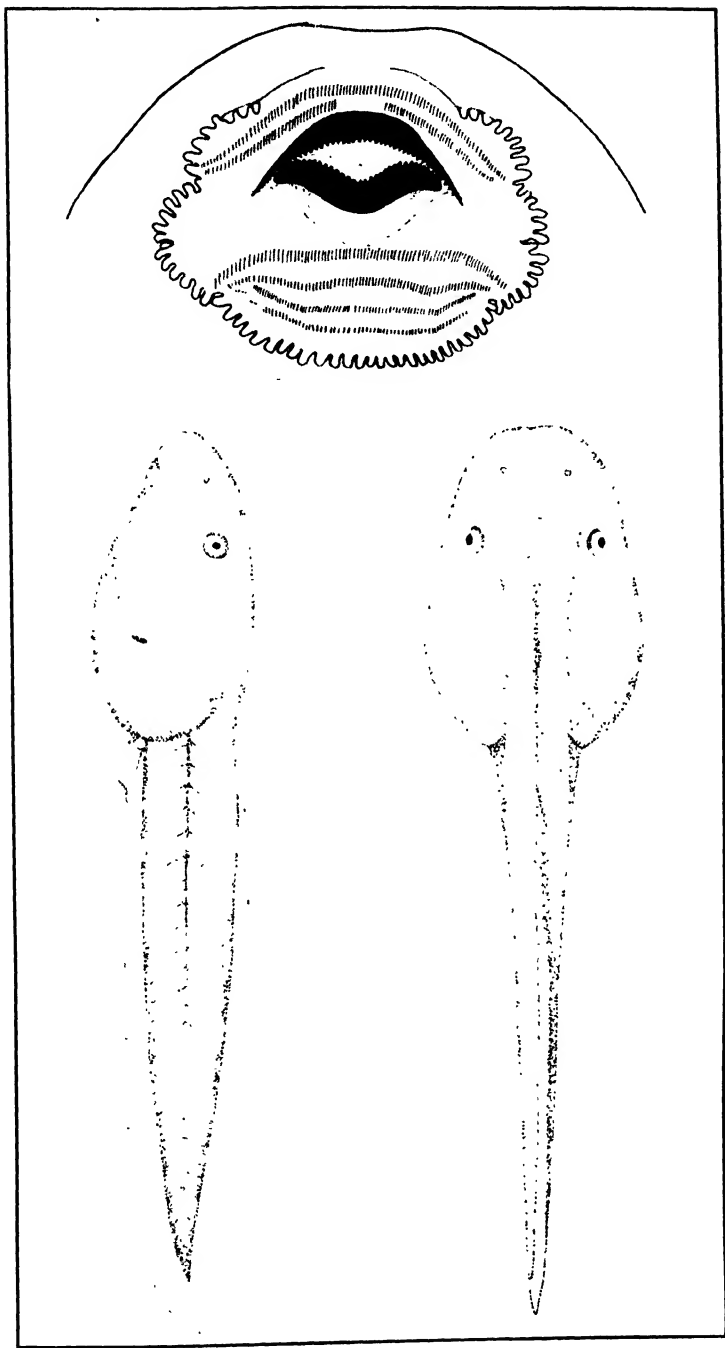


SYRRHOPHUS SMITHI, NEW SPECIES.
Type, U. S. N. M. No. 108594, from Galeana, Nuevo León. Upper figure, $\times 2$; three lower
figures, $\times 3$.



HYLA DENDROSCARTA, NEW SPECIES.

Type, U. S. N. M. No. 108679, from Cuautlapa, Veracruz. Upper figure, $\times 2$; three lower figures, $\times 3$.



HYLA DENDROSCARTA, NEW SPECIES.

Larva. Topotypic paratype, EMIT-HMS No. 23236. Upper figure, mouth, $\times 20$; lower figures, lateral and dorsal views, $\times 4$.

Measurements (in mm.).—Snout to vent, 35; width of head, 12.8; length of head, 12.1; arm, 20.2; leg, 57; tibia, 19.2; foot, 24.8.

Description of the tadpole.—Head and body in profile feebly arched, the dorsal region rather flattened; outline of the body seen from above is broadly ovoid, slightly truncate anteriorly. The mouth is ventral; lips moderately narrow, their borders papillate; dental formula of anterior lip 1+1+1; of posterior lip 1+1+1+1; upper beak broader than lower, both with distinct serrations on edge; upper beak crescentic, lower, broadly V-shaped.

Nostrils dorsal, nearly midway between eye and tip of snout; spiracle sinistral, tubular; vent sinistral, forming a short tube.

Tail very long with about 27 segments discernible; tip pointed; fin arising some distance back from base of tail on dorsal surface, and reaching body on under edge of tail, widest near the tip; eyes blackish.

Color of tadpole in life.—Specimens are grayish flesh color in life; under the lens there is discernible a peppering of dark pigment over anterior dorsal part of head and body; on the tail the pigment is extremely sparse, a few dots being visible near the base of the fin.

Remarks.—The specimens were obtained from bromeliad plants in trees in the vicinity of the village of Cuautlapa. The eggs are laid in the plants, and the young pass through a fairly typical larval stage.

I found one lot of freshly laid eggs, which I presumed belonged to this species, on August 18, 1939. They were in a plant only about 6 feet from the ground on a stump. In other plants in the same locality numerous tadpoles were taken, some having well-developed limb buds. In specimens collected in the middle of September one was found transformed.

Many adults in life are generally creamy yellow above and lemon yellow on the posterior part of venter.

The openings of the vocal sacs are posterior and relatively very small, the throat shows no typical wrinkling.

The relationship may be with the small bromeliad frog *Hyla melanomma* (in press) from Guerrero. The species differs from all other known Mexican hylas in the pigmentation of the gums.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3094

THE WEST AMERICAN HALIOTIS

BY PAUL BARTSCH

SEVERAL interesting sendings of sea-ears from California by A. Sorensen made it necessary to subject the West American members of the genus *Haliotis* to a critical examination. The results are noted below. I am deeply indebted to Mr. Sorensen for the fine specimens sent us, which not only materially expand our series of the developmental stages of some species but also add several new forms to the Californian faunal area. To Prof. H. H. Plough and the authorities of Amherst College I am greatly obliged for the privilege of examining and figuring the type of *Haliotis ponderosa* C. B. Adams, which I am here reestablishing as a good species.

Mr. Sorensen has also given me some interesting notes on the color of *Haliotis* animals from which I quote: "Those with black bodies are: *Haliotis rufescens* Swainson and *H. cracherodii* Leach and its varieties. Those with yellowish and dark spotted bodies are: *Haliotis assimilis* Dall, *H. kamtschatkana* Jonas, *H. walallensis* Stearns, *H. fulgens* Philippi, *H. corrugatus* Gray, and *Haliotis*, new species" (*Haliotis sorenseni*, described herein.) He also states: "I am quite well acquainted with the California coast, since 1885 continuously, and with the abalone industry. The largest catch comes into Monterey, the second to Morro Bay, and a few to Avila. There is no regular commercial abalone fishing south of Avila, but occasionally some of the boats go south to Santa Barbara, and what catch they make there and up to Point Conception is sent by truck to Monterey." These are facts of importance to students of abalones as well as to the men commercially interested in the group.

Genus HALIOTIS Linnaeus

HALIOTIS SORENSENI, new species

PLATE 6

Shell large, thin, the exterior brownish red, decidedly inflated, spire well elevated. Between the line of strongly elevated craterlike siphonal perforations, of which the last four or five are open, and the edge of the shell the upper three-fourths is gently rounded, while the outer quarter flares to a considerable expansion, which produces a decided, concave line at the inner edge of the outer fourth of this part of the shell. The outer surface is marked by more or less regular, broad, low, axial ridges, which bear irregularly developed, not strongly pronounced, nodules. The outside is further provided with numerous closely placed, slender, spiral cords that vary materially in strength and with numerous closely spaced, incremental lines that almost equal the spiral cords in strength. In addition to this sculpture, broad, low, elevated, axial areas, which are feebly nodulose, alternate with depressed zones. The interior of the shell is iridescent with a pinkish pearly hue prevailing, and bright rosy tints mark the outer half, while within, scattered greenish areas of irregular size and distribution are present. The muscle scar, usually strongly marked in *Haliotis*, is here but feebly impressed, in which character it resembles the other Californian deep-water species, *Haliotis assimilis*. It resembles that form also in the excavated inward sloping of the expanded dextral margin of the aperture and the sealing-wax-colored edging of the peristome, but differs materially in size and in the color of the interior.

The type, U.S.N.M. No. 535688, resting upon the aperture, yields the following measurements: Greater length, 218 mm.; greater diameter, 168 mm.; height, 81 mm. It weighs 448 grams.

Two paratypes in Mr. Sorensen's collection yield the following measurements, respectively: Greater length, 200, 210 mm.; greater diameter, 149, 172 mm.; greater height, 79, 65 mm.; weight, 370, 465 grams. Of these specimens Mr. Sorensen writes: "They were found slightly south of Point Conception, Calif., by a commercial abalone diver, in 10 fathoms depth. After one was found, diligent search for 2 weeks succeeded in finding only three more. No other diver found any; the time was about September 15, 1939." A subsequent letter states: "The animal was colored yellowish with dark specks, and the meat was quite tender."

Recently, on his way to Mexico, Mr. Sorensen found a curio dealer near San Diego who had secured a number of what he called the pink abalone from a man who had brought Mexican shells north to him.

Mr. Sorensen has sent two of these to me, and I find that they agree in every way with the type but are somewhat smaller. Their measurements are, respectively, as follows: Height, 63, 51 mm.; greater diameter, 165, 156 mm.; lesser diameter, 132, 123 mm. The dealer stated that they were very rare, and he believed that they originated from some of the islands offshore, probably Guadalupe; we therefore have an additional station, which materially extends the known range of the species.

HALIOTIS ASSIMILIS Dall

1878. *Haliotis assimilis* DALL, Proc. U. S. Nat. Mus., vol. 1, p. 46.

This strongly inflated, oval species we had in the collection of the National Museum from the region of San Pedro and San Diego, where it was said to occupy rather deep water. Mr. Sorensen's sending has extended its known range as far northward as Monterey County.

HALIOTIS RUFESCENS Swainson

This species extends from Mendocino County, Calif., to the off-lying islands to the south. The typical race is an important element in the West American abalone fisheries.

I am recognizing three subspecies, as follows:

HALIOTIS RUFESCENS RUFESCENS Swainson

1822. *Haliotis rufescens* SWAINSON, Appendix to the Bligh Catalogue, Exotic conchology, ed. 2, p. 34.

1832. *Haliotis californiana* VALENCIENNES, Recueil d'observations de Zoologie . . . Voyage Humboldt et Bonpland, vol. 2, p. 267.

This gigantic race ranges from Mendocino County, Calif., south to Catalina Island.

The two largest specimens in our collection, U.S.N.M. No. 535758, donated by Mr. Sorensen, yield the following measurements, respectively: Height, 87, 76 mm.; greater diameter, 251, 257 mm.; lesser diameter, 213, 218 mm.; weight, 1,528, 1,062 grams.

HALIOTIS RUFESCENS WALALLENSIS Stearns

1900. *Haliotis fulgens walallensis* STEARNS, Proc. U. S. Nat. Mus., vol. 22, p. 140.

1921. *Haliotis wallalensis* DALL, U. S. Nat. Mus. Bull. 112, pl. 22.

This small northern race was described by Dr. Stearns from Gualala, Mendocino County, Calif. Its narrower shape, less rugose surface, and smaller size differentiate it from the typical race.

HALIOTIS RUFESCENS HATTORII, new subspecies

PLATE 8, FIGURES 4-6

Shell small, oval, rather flat, spire depressed, with a slight auricle where the outer lip joins the preceding whorl at the summit. The color of the first half of the shell is blue, slightly variegated with red. The last half is banded with zones of red and bluish white. The sculpture consists of irregular lines of growth and indications of axial waving. The spiral sculpture consists of low, flattened threads, which are not quite so wide as the spaces that separate them. These, in combination with the incremental lines, give the surface a somewhat clothlike texture. The siphonal angle bears moderately elevated craters, the last four of which are open. Between this siphonal line and the edge of the aperture the shell is rounded and marked like the surface posterior to the siphonal line. The entire outer surface has a waxy appearance. The interior is pearl-gray with iridescent tints, the outer edge of the outer lip being pale reddish. The right edge of the aperture is slightly crenulated; the left edge is rather broadly expanded and flattened, sloping outward, the shelf being about the same width on the parietal wall. Muscle scar poorly differentiated.

The type, U.S.N.M. No. 535761, was collected by Mr. Hattori, an abalone diver, near Santa Barbara, for whom I take pleasure in naming the form. When placed on the aperture it yields the following measurements: Height, 18 mm.; greater diameter, 100 mm.; lesser diameter, 74 mm.

This subspecies can be differentiated easily from typical *Haliotis rufescens rufescens* by its very flat shape, the very poorly elevated spiral threads, the waxy surface, and by lacking the elevated tumid area between the siphonal line and the edge of the aperture. From *H. rufescens walallensis* it is easily distinguished by its much broader shape and feebler sculpture.

HALIOTIS PONDEROSA C. B. Adams

PLATE 7

1848. *Haliotis ponderosa* C. B. ADAMS, Amer. Journ. Sci. and Arts, ser. 2, vol. 6, pp. 138-139.

Shell large, very heavy, strongly inflated, spire well elevated. The exterior is brownish red, rough, and somewhat worn. It shows irregularly developed and distributed, weakly irregularly nodulose axial ridges and very rough incremental lines, as well as indications of spiral cords. Anterior to the line of siphonal craters, the last four of which are open, the shell is moderately elevated and strongly rounded. On the early part of the last turn it has a broad, feebly

developed, median tumid ridge. The dextral and parietal walls of the aperture are broadly expanded, sloping slightly inward, but not excavated. Interior iridescent with pearly gray tint prevailing. Muscle scar large, rugose-granulose.

The type, deposited at Amherst College, yields the following measurements: Greater length, 215 mm.; greater diameter, 167 mm.; height, 80 mm.; weight, 965 grams.

The shell appears nearest related to *Haliotis rufescens*, from which the ponderous shell, well-elevated spire, and pale interior (*H. rufescens* has the lively iridescent-green color scheme) readily differentiate it.

It is to be regretted that Professor Adams was unable to give any information about the habitat of this abalone. I believe that it should be looked for in southern California on extremely exposed and surf-beaten ledges.

HALIOTIS FULGENS Philippi

1845. *Haliotis fulgens* PHILIPPI, Zeitschr. für Malak., vol. 2, p. 150.

1846. *Haliotis splendens* REEVE, Conchologia iconica, fig. 9.

1846. *Haliotis planilirata* REEVE, Conchologia iconica, fig. 62.

This species possesses remarkably uniform characters. We have it in the United States National Museum collection from San Diego to Cape San Lucas, from Catalina, Santa Rosa, Guadalupe, San Bonita, and Cerros Islands, and a young specimen from La Paz, within the Gulf.

HALIOTIS AULAEA, new species

PLATE 8, FIGURES 1-3

Shell of medium size and rather low, spire slightly elevated. The color scheme of the exterior is a mixture of green and red, more or less disposed in interrupted spiral zones, producing a tapestry-like effect. Interior pearl-gray, edge of peristome variegated chiefly with green. The exterior is marked by numerous flattened spiral cords, which vary materially in size, usually finer ones separating the broad elements. In addition there are obliquely protractively, radiating nodulose ridges, the nodules being depressed. The surface likewise has numerous incremental threads, which render the finer cords minutely nodulose and the rest lirate. The siphonal angle bears numerous craterlike projections, the last six of which are open. Anterior to the siphonal angle there is a rather strong spiral cord midway between this ridge and the basal edge of the shell. This part of the shell is also marked by spiral cords, a little finer than those on the spire, and by the continuation of the incremental elements. The aperture is broadly oval, the outer edge of the peristome is acute,

while the posterior portion of the inner lip slopes materially inward. The surface of the inside is wavy and its color pearl-gray.

The type, U.S.N.M. No. 535848, was collected by A. Sorensen in 8 to 10 fathoms off Cayucas, Calif. It measures: Height, 34 mm.; greater diameter, 110 mm.; lesser diameter, 85 mm.

U.S.N.M. No. 535849 contains four additional specimens, which range from a length of 53 mm. to almost the size of the type. These came from 10 to 15 fathoms off the southern part of Monterey County, Calif. Two others, U.S.N.M. No. 535850, came from off Port San Luis Obispo, Calif.

This species suggests slightly *Haliotis kamtschatkana* but is much broader than that. It reminds one also of *H. assimilis*, but its coarse sculpture at once removes it from that association.

HALIOTIS KAMTSCHATKANA Jonas

1845. *Haliotis kamtschatkana* JONAS, Zeltschr. für Malak., vol. 2, p. 168.

This narrow, rough species, with spire highly elevated, is represented in our collection by specimens taken at points ranging from Alaska south to Monterey Bay.

HALIOTIS SMITHSONI, new species

PLATE 8, FIGURES 7-9

Shell large, with a strongly mammillated spire, whose whorls are separated by a rather deeply impressed suture. From the summit to the row of siphonal apertures the whorls are almost straight, a little convex on the last portion of the last turn. The siphonal openings are craterlike, the last three or four being open. The sculpture between the summit of the whorl and the siphonal line consists of coarse incremental lines that develop into inconspicuous, low, rounded ridges, which are almost regular in distribution; these ridges bear obsolete, ill-defined nodules. In addition there are slender spiral threads, which are of varying width and differ slightly in spacing. Between the siphonal line and the edge of the aperture there is a low, raised keel a little posterior to the median line. The space between this rounded keel and the siphonal line is slightly concave and marked by incremental lines and spiral threads. Anterior to this submedian line the shell is slightly rounded and marked by the continuation of the rugose radial threads referred to for the spire and spiral threads. The aperture is oval and is sharp on the dextral margin, while the left margin is moderately broad and slopingly excavated. This slope extends over the parietal wall, where it is a little broader. The muscle scar is rather pronounced. The color

scheme of the interior is pearly gray with iridescent, prismatic, scattered flashes.

The type, U.S.N.M. No. 60425, comes from Catalina Island. Placed flat on the aperture it measures: Height, 57 mm.; greater diameter, 140 mm.; lesser diameter, 107 mm.

There are two additional specimens in our collection, one of which, a little smaller than the type, U.S.N.M. No. 98329, collected by Dr. Cooper at Santa Cruz Island, measures: Height, 50 mm.; greater diameter, 119 mm.; lesser diameter, 94 mm. The other, U.S.N.M. No. 11868, a very large specimen, bears the locality label San Diego, which I somewhat question. This measures: Height, 77 mm.; greater diameter, 193 mm.; lesser diameter, 148 mm.

This species suggests *Haliotis kamtschatkana*. Its gigantic size and comparatively feeble sculpture will readily distinguish it from that. I take pleasure in naming it for the founder of the Smithsonian Institution, James Smithson.

HALIOTIS DALLI Henderson

1915. *Haliotis (Padollus) dalli* HENDERSON, Proc. U. S. Nat. Mus., vol. 48, p. 661, pls. 45, 46 (lower figures).

This small species of *Haliotis* was dredged by the United States Bureau of Fisheries steamer *Albatross* in 33 fathoms near Charles Island, Galapagos.

HALIOTIS CRACHERODII Leach

This species ranges from San Francisco to San Quentin Bay, along the mainland; in other words, through the major portion of the Californian faunal area, stretching, however, over part of the Oregonian area to the north. It extends also over the off-lying islands.

Haliotis californiensis Swainson must be relegated to the rank of subspecies, for the organisms on Cerros and San Bonita Islands form perfect intergrades between the typical *H. cracherodii* and *H. californiensis*. Two subspecies, therefore, will be recognized.

HALIOTIS CRACHERODII CRACHERODII Leach

1817. *Haliotis cracherodii* LEACH, Zool. Misc., vol. 1, p. 31, pl. 58.

1892. *Haliotis cracherodii splendidula* WILLIAMSON, Proc. U. S. Nat. Mus., vol. 15, p. 198.

1900. *Haliotis rosea* ORCUTT, West Amer. Sci., vol. 10, p. 30.

1900. *Haliotis corrugata diegoensis* ORCUTT, West Amer. Sci., vol. 10, p. 31.

1907. *Haliotis cracherodii holzneri* HEMPHILL, Trans. San Diego Soc. Nat. Hist., vol. 1, p. 59.

1919. *Haliotis cracherodii imperforata* DALL, Proc. U. S. Nat. Mus., vol. 56, p. 370.

1921. *Haliotis cracherodii holzneri* DALL, U. S. Nat. Mus. Bull. 112, pl. 20.

1921. *Haliotis cracherodii imperforata* DALL, U. S. Nat. Mus., Bull. 112, pl. 21.

This subspecies differs from *Haliotis c. californiensis* in having the perforations much larger and more distantly spaced, and consequently much less numerous.

The other named shells placed in the synonymy of this subspecies above I believe represent individual variations, not isolated geographic races, which if they must be referred to by name had best be designated "forms" rather than "subspecies."

This subspecies embraces all *Haliotis cracherodii* except those from Guadalupe Island:

HALIOTIS CRACHERODII SPLENDIDULA Williamson:

Mrs. Williamson stated under the above designation that a number of shells found at one time at Point Vincent, Calif., have brilliant blotches of color in their interior, somewhat like *H. fulgens* Philippi, and some have spots of brown.

HALIOTIS CRACHERODII HOLZNERI Hemphill:

The specimen figured by Dr. Dall, U.S.N.M. No. 199890, is a distorted, decidedly twisted, individual having perforations. Hemphill's description calls for an absence of perforation, in which respect *Haliotis cracherodii holzneri* would agree with *Haliotis imperforata* Dall.

HALIOTIS CRACHERODII IMPERFORATA Dall:

Under this Dr. Dall says: "In the Nautilus for December, 1910 (p. 96), I described a unique form of this species which is entirely imperforate, never having had any perforations, but appears normal in every other respect. While this can hardly be termed a variety it seems well to give it a name in order that it may be kept in mind by those interested in teratology of mollusca. The specimen is U. S. Nat. Mus. Cat. No. 219850, and measures 100 mm. in length by 42 in height and 95 in width, and was collected on the coast of California not far from San Pedro."

HALIOTIS ROSEA Orcutt:

Orcutt distinguished this from the typical form on account of its "rich, extremely beautiful, reddish epidermis."

HALIOTIS CORRUGATA DIEGOENSIS Orcutt:

The type of Mr. Orcutt's subspecies is in the collection of the U. S. National Museum (No. 162007) and is plainly a large, decidedly worm-eaten, senescent *Haliotis cracherodii*.

HALIOTIS CRACHERODII CALIFORNIENSIS Swainson

1823. *Haliotis californiensis* SWAINSON, Zool. Illus., ser. 1, vol. 2, pl. 80.

1900. *Haliotis bonita* ORCUTT, West Amer. Sci., vol. 10, p. 30.

This is the subspecies with the small and numerous perforations. Our large series of specimens from Guadalupe Island agree perfectly with Swainson's figures, and they are the only ones that absolutely satisfy them. I therefore believe that the type locality for *H. californiensis* is Guadalupe.

The type of Orcutt's *Haliotis bonita*, U.S.N.M. No. 162008, bears on its label "near Santa Barbara, California," but in his description he adds, after citing Santa Barbara, "It is evidently rare and may be from Mexican waters."

I agree with this last statement for it undoubtedly came from Guadalupe Island.

In addition to the living species referred to above, the following fossil *Haliotis* have been described from California:

HALIOTIS LOMAËNSIS F. M. Anderson

1902. *Haliotis lomaënsis* F. M. ANDERSON, Proc. California Acad. Sci., ser. 3, Geology, vol. 2, p. 75, pl. 9, fig. 183.

Dr. Anderson described a specimen from the Cretaceous of the lower Chico bed of San Diego County, Calif.

The type is No. 65 of the California Academy of Sciences Invertebrate Paleontological collection.

HALIOTIS PALEA Woodring

1931. *Haliotis palea* WOODRING, Journ. Pal., vol. 50, pp. 38, 39, pl. 6, figs. 1-3.

This species comes from the Miocene of the south slope of Santa Monica Mountains, south end of the ridge along the east side of Brown Canyon, Los Angeles, Calif.

The type is No. 1206 in the California Institute of Technology.

Dr. Woodring considers this related to *Haliotis corrugata* Gray, with which I agree.

HALIOTIS LASIA Woodring

1932. *Haliotis lasia* WOODRING, Proc. U. S. Nat. Mus., vol. 81, pp. 1-4, pl. 1.

This species was described by Dr. Woodring from the Miocene of Temblor Range, San Luis Obispo County, Calif.

The type, U.S.N.M. No. 371767, and 19 paratypes, U.S.N.M. No. 371768, are listed.

Dr. Woodring considers this most nearly related to *Haliotis fulgens* Philippi.

HALIOTIS ELSMERENSIS Vokes

1935. *Haliotis elsmereensis* VOKES, Journ. Pal., vol. 9, pp. 251-252, pl. 25, figs. 22, 23.

This species was described by Dr. Vokes from the Pliocene of Elsmere Canyon, Los Angeles County, Calif. He says it is related to *H. rufescens* Swainson.

The type is No. 32465 of the University of California Museum of Invertebrate Paleontology.

HALIOTIS KOTICKI Hertlein

1937. *Haliotis koticki* HERTLEIN, Bull. Southern California Acad. Sci., vol. 36, pp. 94-96, pl. 42, figs. 1, 2.

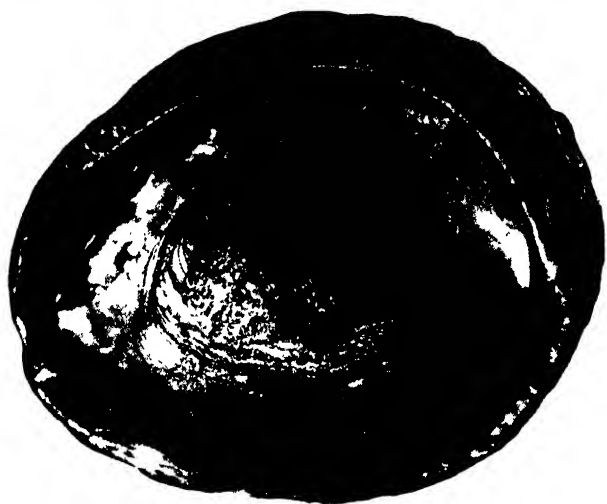
This species comes from the lower Miocene west of Zaca Peak, central part of Lompoc Quadrangle, Santa Barbara County, Calif.

The type is No. 286 in the California Academy of Sciences Invertebrate Paleontological collection.

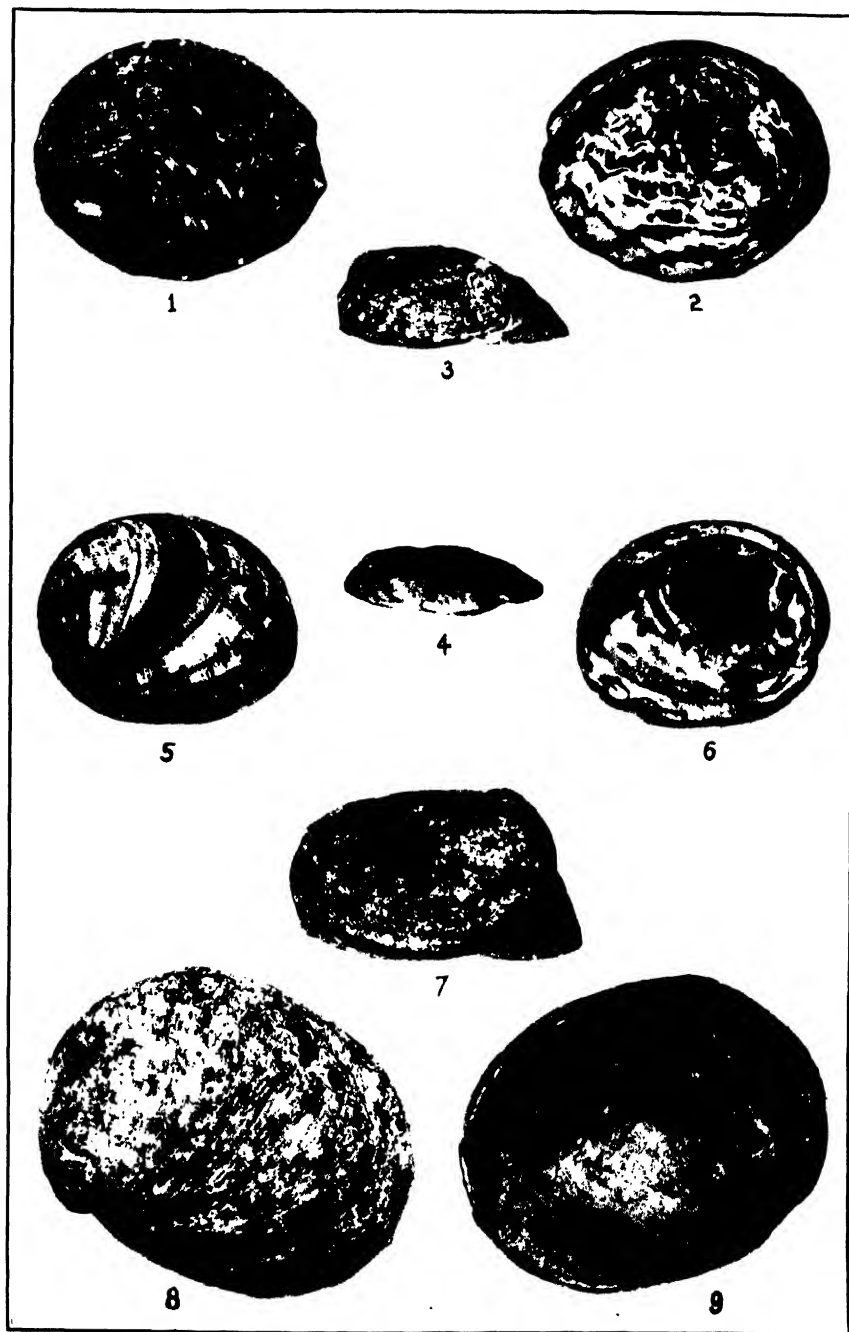
Hertlein considers this related to *H. corrugata* and *H. kamtschatkana* Jonas.



HALIOTIS SORENSENI, NEW SPECIES.



HALIOTIS PONDEROSA C. B. ADAMS.



NEW SPECIES AND SUBSPECIES OF HALIOTIS.

1-3, *H. aulaea*; 4-6, *H. rufescens hattorii*; 7-9, *H. smithsoni*.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1940

No. 3095

REVISION OF THE SCARABAEID BEETLES OF THE PHYLLOPHAGAN SUBGENUS LISTROCHELUS OF THE UNITED STATES, WITH DISCUSSION OF RELATED SUBGENERA

By LAWRENCE W. SAYLOR

Listrochelus was described as a genus by Blanchard in 1850, with *L. laportaei* (from Mexico) as the type species. In 1878 Horn published a revision of the United States species, and other than scattered descriptions there has since been no further revision of the group. The present paper treats 39 species and subspecies, of which 20 are herein described as new; also listed are four Mexican species that have not heretofore been recorded from north of the Rio Grande. The material studied consisted of 1,571 specimens (1,003 males and 568 females) lent by all the major private and public collections of the country. All the figures were drawn by the author.

The species considered as belonging to this group present a rather varied appearance, and nearly all types of structural modifications between species found in the typical portion of the genus (*Phyllophaga* sensu stricto) occur; as yet, however, no species of *Listrochelus* is known to me in which one of the hind tibial spurs in the male is immovable or in which the middle male tarsal claws are "deformed."

Nearly every serious student of the group has expressed at one time or another the opinion that *Listrochelus* was not tenable as a genus and either that its boundaries be modified or else that it be suppressed entirely. With more than twice the number of species known to previous workers before me, I am unable to find characters that will sustain *Listrochelus* as a valid genus. True, there are a certain num-

ber of species that by the strongly pectinate tarsal claws and prominent transverse carina of the vertex appear to form well-marked groups, but when an attempt is made to separate these groups generically or even subgenerically on good characters the hopelessness of the task is at once apparent. In certain species, whose males have the tarsal claws strongly pectinate or serrate, the claws of the female are toothed and have hardly visible serrations, and such females are separable from *Phyllophaga* only by possessing a frontal carina. On the other hand, such species as *Listrochelus cavata* Bates, *L. meadei* Saylor, *L. cochisa* Saylor, and *L. micros* Bates do not have any trace of the transverse frontal carina, nor do they have even the posterior area of the front marked by a transverse boundary of rugose punctures (as in *L. timida* Horn and *L. senex* Horn), but they do have (at least in the male and much less noticeably so in the female) strongly pectinate or serrate tarsal claws, so that their inclusion in the *Listrochelus* group of species is necessary. The only alternatives (other than suppressing *Listrochelus* entirely) are to erect half a dozen or more purely artificial genera or else to reduce the name *Listrochelus* to a subgenus of *Phyllophaga* (into which it grades gradually and completely through such species as *L. cavata* and allies, *L. senex*, *L. timida*, and others to a lesser extent), and I feel that the latter course is justified and necessary. Admittedly, by preserving *Listrochelus* as a valid name at all we are maintaining a somewhat poorly defined unit of *Phyllophaga* (since the two must be separated by a combination of characters any one of which may fail), but since by so doing proper identification of the included species is facilitated, certain purposes of taxonomic research are better served.

In a recent revision of the United States *Phytalus* (1939) the author found it necessary to reduce that group to subgeneric standing under *Phyllophaga*. In this connection the two genera *Chirodines* Bates and *Chlaenobia* Blanchard may be mentioned: the former is separated from *Phytalus* only through having the tarsal claws of the anterior and middle legs of the male (female unknown) simple. This is obviously a poor character upon which to separate genera, as we have many instances in other genera and subgenera where the teeth on the claws vary widely within the group (e. g., *Anoplosiagum*, *Listrochelus*). Until the female is found and is proved also to possess simple anterior tarsal claws as does the male, I prefer to regard *Chirodines* as at most a subgenus of *Phyllophaga*.

The genus *Chlaenobia*, ably revised by Chapin in 1935, is separated from *Phytalus* only through having the "male tarsal segments thickened and densely pilose below"; *Phytalus chlaenobiana* Saylor is practically inseparable externally from the male *Chlaenobia tumulosa* Bates both by general facies and characters, if the pilose and broad-

ened tarsal segments of the latter are omitted from consideration. *Chlaenobia vexata* Horn and *C. unituberculata* Bates have the male tarsal segments only slightly more pilose than in normal male *Phytalus*, while the segments themselves are not at all expanded. The front tarsal segments are expanded in male *C. latipes* Bates, *C. tumulosa*, etc., and not at all so (even though pilose below) in *C. aequata* Bates, *C. colimana* Arrow, *C. vexata* Horn, etc. The situation here is exactly comparable to that in *Liogenys* Guérin, wherein the tarsal segments may vary in the male from normal size to twice or even three times the normal width—this being therefore a sexual and specific variation and not to be considered of generic importance. Thus the differences between *Chlaenobia tumulosa* on the one hand and *Phytalus chlaenobiana* on the other are fully bridged over in the species *C. vexata* and *unituberculata*, and the only alternative to suppressing *Chlaenobia* entirely is to keep it as a subgenus of *Phyllophaga*; moreover, the generic differences as set up between *Phytalus* and *Chlaenobia* hold only in the male sex.

In this connection I wish to quote a short paragraph from an article by G. J. Arrow (of the British Museum of Natural History), who has had wide and varied experience in scarab taxonomy for a good many years. Mr. Arrow says (1938) in speaking of a scarab genus: "Those who see advantage in the multiplication of generic names may perhaps discover some diagnostic feature by which the retention of one or both these names may be rendered possible. Such attempts seem to me, however, to be only resisting an inevitable process. As more and more species of any group become known, previously apparent gaps in the series necessarily become filled, and the disappearance of many genera is as natural as their erection at an earlier date, when the known species were fewer." With this statement I heartily concur.

By treating *Chlaenobia* as a subgenus of *Phyllophaga*, most closely allied to the subgenus *Phytalus*, and restricting to it those species having closely cleft tarsal claws in both sexes, and the tarsal segments in the male more densely pilose than normal (with also widened tarsal segments in some of the species), I believe the status and true relationships of these subgenera will be better evidenced than by using any other arrangement.

ACKNOWLEDGMENTS

It is a pleasure to acknowledge the assistance of many individuals and institutions. Those contributing material for study or assisting in other ways were: Dr. E. A. Chapin, the material in the U. S. National Museum and the Casey Collection; G. J. Arrow, of the

British Museum, for comparing specimens of United States species with Bates' types, as well as for numerous previous favors; H. J. Reinhard, Agricultural and Mechanical College of Texas; Milton Sanderson and the authorities of the University of Kansas Entomological Museum; Prof. E. C. Van Dyke, Dr. Abe Michelbacher, Mont A. Cazier, and Edward Ross, of the University of California; O. L. Cartwright, of Clemson College; Mark Robinson, of Philadelphia, Pa.; Dr. W. Dwight Pierce, of the Los Angeles Museum; Dr. Richard E. Blackwelder and the American Museum of Natural History; and Hugo Kahl, of the Carnegie Museum, Pittsburgh. The large series of the several species from Lower California presented for study by Ross and Michelbacher have been particularly valuable. I am especially indebted to Dr. Chapin for many favors. He compared specimens with the types of LeConte at Cambridge and the types of Horn at Philadelphia. Mrs. Emma L. Henry has rendered valuable clerical assistance in the preparation of the manuscript.

A word concerning the procedure followed in the present paper: In the account under each species are listed the total number of individuals and the localities for all specimens examined; where a species is distributed over a wide range, specific localities are not given but only the approximate boundaries of such range, as evidenced from the material at hand. The names of collectors are given in parentheses, and the collections from whence the specimens came and/or are at present housed are indicated by enclosure within brackets. In the bibliography a note is given defining the nature and scope of each article listed.

In some places in the key use has been made of the genitalia characters to separate species; this is necessitated by the fact that these species exhibit such slight external differences that series of each must be carefully compared to determine them correctly, while if the genitalia are used the specimens may be quickly and positively placed.

KEY TO THE AMERICAN SUBGENERA OF PHYLLOPHAGA

1. Tarsal claws of anterior and middle legs simple, neither cleft nor toothed (female unknown) (Mexico)..... **Chirodines** Bates
Claws of all legs pectinate, cleft, or variously toothed..... 2
2. Claws of tarsi narrowly cleft, angle formed by cleft being acute at least in males; females frequently with cleft much more obtuse, rarely grading into almost a median tooth..... 3
Claws toothed, pectinate or serrate, never cleft..... 4
3. Tarsal segments densely to moderately pilose beneath, less obviously so in females (segments broadened in males of some species); color usually light testaceous (Central America and United States)..... **Chlaenobia** Blanchard
Tarsal segments at most very sparsely pilose beneath, segments never broadened in either sex; color variable (North and South America)..... **Phytalus** Erichson

- . Claw with a strong to moderate tooth, position of latter variable, claw never with serrations or pectinations; tarsi never densely pilose; vertex of head plane, never transversely carinate (North and South America).....**Phyllophaga** Harris
- Claw finely or coarsely serrate to pectinate, with or without a larger intercalated triangular tooth; vertex usually with a well-marked transverse carina, the latter reduced in some species and entirely absent in some; tarsi in some few species densely pilose or ciliate in male (Southwestern United States and Mexico).....**Listrochelus** Blanchard

KEY TO THE MALES OF LISTROCHELUS

1. Head densely, coarsely, and entirely punctate behind transverse carina of vertex; tarsal claws pectinate or serrate along a single margin (figs. 2, *f*, *i*) without a larger intercalated tooth (serrations of margin frequently hardly noticeable); not densely hairy above..... 2
- Head rarely punctate behind transverse carina and then only at sides, with at least a large portion of vertex impunctate, more commonly the entire surface posterior to carina impunctate; claw variably serrate or pectinate along a single or double margin; if with characters as in preceding couplet, then with dense short hair dorsally (*pilosipes*)..... 3
- 2 (1). Claw with serrations obvious to nearly absent (fig. 2, *j*); antenna unicolorous rufotestaceous, club usually shorter than, or subequal to, funicle (genitalia, fig. 3, *a-c*)... **timida** (Horn)
Claw definitely pectinate; antennal club testaceous, lighter in color and slightly longer than funicle (genitalia, fig. 3, *d-f*)..... **snowi**, new species
- 3 (1). Claw definitely pectinate (fig. 2, *f*)..... 4
- Claw serrate (figs. 2, *h*, *i*), serrations rather strong to faint..... 23
- 4 (3). Claw pectinate along two margins (fig. 2, *g*)..... 13
- Claw pectinate along one margin (fig. 2, *f*)..... 5
- 5 (4). Genitalia symmetrical (fig. 12, *a*); transverse carina of vertex obsolete, clypeus plane; dorsal surface glabrous or nearly so; sixth abdominal segment plane (*cavata* and related species)..... 6
- Genitalia asymmetrical (figs. 5, *c*, *h*); transverse carina strong, or if weak then clypeus strongly tumid at base; densely hairy above, or if glabrous then sixth abdominal segment either with a deep fovea or large and flattened and with scabrose, setigerous punctures..... 9
- 6 (5). Genitalia in *en face* view with apices bluntly rounded or bluntly pointed, apices never reflexed (fig. 12, *d*, *g*)..... 7
- Genitalia in *en face* view with apices narrow and pointed and strongly to moderately reflexed toward sides (fig. 12, *l*)..... 8
- 7 (6). Genitalia with tips pointed but bluntly so, not at all reflexed toward sides (fig. 12, *d-f*) (Mexico and New Mexico)..... **cavata** (Bates)
- Genitalia tips bluntly rounded, neither pointed nor reflexed (fig. 12, *g-i*) (Colorado and Mexico)..... **micros** (Bates)

- 8 (6). Genitalia tips very narrow and strongly reflexed (fig. 12, *j-l*) (Mexico) ----- **meadel**, new species
 Genitalia pointed and very acute at tip, the tips only slightly reflexed toward sides (fig. 12, *a-c*) (Arizona and Mexico)----- **cochisa**, new species
- 9 (5). Dorsal surface covered with moderately dense and short hair; antennal club much shorter than funicle; sixth abdominal segment slightly convex (genitalia, fig. 11, *l-n*)----- **pilosipes**, new name
 Thorax and head usually subglabrous; antennal club equal to funicle; sixth abdominal segment very long, either foveate or flattened----- 10
- 10 (9). Base of clypeus hardly or not at all tumid, front flattened; thorax polished, densely punctate, not rugose; sixth abdominal segment strongly flattened, never even slightly concave, with fine scabrose punctures, the hairs short and not dense; genitalia in lateral view with only one apical tooth (fig. 5, *i-n*)----- **miraflores**, new species
 Clypeal base always tumid, front always coarsely and usually rugosely punctate; thorax variable, rugosely punctate or not; sixth abdominal segment always broad and either slightly or markedly concave or foveate (never merely flattened as in *miraflores*), scabrous punctures and short erect hairs denser than in *miraflores*; genitalia in lateral view always with two rather obvious teeth (fig. 5, *b, g*)----- 11
- 11 (10). All of thoracic disk closely, coarsely, and rugosely punctate; middle base of clypeus strongly tumid; posterior margin of transverse carina on vertex very coarsely and closely punctate; genitalia in *en face*-dorsal view with lateral margins of the two teeth nearly parallel (fig. 5, *f*); upper tooth in lateral view of moderate length (fig. 5, *e*).
densicollis (LeConte)
 Thoracic disk less densely punctate, if rugose at all then along the apical margin only, center of disk usually with an impunctate area; transverse carina less densely punctate; genitalia in *en face*-dorsal view slightly to strongly expanded toward the outside (figs. 5, *c, h*); upper tooth in lateral view either very short (fig. 5, *b*) or of moderate length (fig. 5, *g*)----- 12
- 12 (11). Genitalia in *en face*-dorsal view slightly expanded toward sides and in lateral view with upper tooth markedly shorter than lower (fig. 5, *b, c*)----- **carminator** (Horn)
 Genitalia in *en face*-dorsal view strongly expanded toward sides and teeth much longer than in above species; in lateral view the two teeth are approximately same width and length (fig. 5, *g, h*)----- **micelbacheri**, new species
- 13 (4). Hind tarsus densely pilose beneath, pilosity of each segment occurring in a dense patch (fig. 4, *e*); sixth abdominal segment with raised cariniform ridges (fig. 2, *d, e*)----- 14
 Hind tarsus pilose but never densely so; sixth abdominal usually plane or nearly so----- 15

- 14 (13). Surface of sixth abdominal segment strongly ascending (fig. 2, *d*), apex deeply, narrowly cleft, producing a bidentate apex; hind trochanters hardly or not produced (fig. 4, *b*) (genitalia fig. 7, *e, f*)-----**scoparia** (LeConte)
Sixth abdominal with a moderately high, strong, transverse carina, the latter slightly curved and running nearly total width of segment (fig. 2, *e*), edges of carina at each side of segment highly angulate; hind trochanters very strongly and narrowly produced (fig. 4, *a*) (genitalia fig. 9, *d-b*)-----**trochanter**, new name
- 15 (13). Only outer front tarsal claw with a large and definite tooth just before apex----- 16
Both front tarsal claws with pectinations of approximately equal size and no teeth before apex----- 19
- 16 (15). Sixth ventral with small, moderately dense granules; outer claw of middle tarsus usually with small subapical tooth; hair on abdomen (in lateral view) moderately long and fairly dense; pygidium highly polished, very convex (genitalia fig. 8, *j-l*)-----**plena** (Fall)
Sixth ventral without trace of granules; outer claw without any larger tooth; hair of abdomen very short or obsolete, rather sparse if present; pygidium usually with at least the basal half pruinose, slightly to moderately convex----- 17
- 17 (16). Genitalia in lateral view with entire apical margin evenly and slightly reflexed (fig. 8, *d-f*)-----**mucorea** (LeConte)
Genitalia in lateral view with apical margin only slightly reflexed and that at about middle----- 18
- 18 (17). Apical margin of genitalia in lateral view reflexed slightly below center into a short lobe, remainder of margin not reflexed (fig. 8, *g-i*)-----**pulcher** (Linell)
Apical one-third of margin reflexed; general form in lateral view (fig. 8, *a*) quite different from that of either *pulcher* or *mucorea* (fig. 8, *e, g*)-----**reinhardi**, new species
- 19 (15). Elytra testaceous, prothorax rufous; surface never pruinose; clypeus and head very densely punctured; antennal club obviously longer than the funicle; sixth abdominal with deep longitudinal sulcus----- 20
Elytra rufobrunneous to rufopiceous, usually at least slightly pruinose, especially on elytra; clypeus and front moderately densely, not rugosely punctate; sixth abdominal without or with but a very faint indication of a longitudinal sulcus; antennal club equal to, or shorter than, funicle----- 21
- 20 (19). Antennal club equal to funicle or not more than one-fifth longer than the latter; clypeus plane at center base (genitalia fig. 10, *a-d*)-----**flavipennis** (Horn)
Antennal club one-fourth to one-third longer than funicle; clypeus usually strongly tumid at center base, at least noticeably so (genitalia fig. 10, *e-h*)-----**granti**, new species
- 21 (19). Elytra coarsely punctured and rugose, never more than faintly pruinose; thorax rufocastaneous; sixth abdominal segment with longitudinal sulcus moderately impressed,

- without traces of lateral oblique carinae (genitalia fig. 6, *a-d*)-----*disparilis* (Horn)
- Elytra always pruinose, usually markedly and densely so, usually finely punctate and hardly rugose; sixth abdominal segment with a much deeper impressed sulcus each side of which is a faint, lateral, oblique impression----- 22
- 22 (21). Genitalia in *en face* view with upper margin deeply emarginate each side between center top and point of greatest width (fig. 7, *a-d*); in lateral view apical margin is slightly reflexed at middle; lower apex of genital stem without bristles or with very small fine ones-----*huachuca*, new species
- Genitalia in *en face* view gently curved each side of middle top to point of greatest width at each side (fig. 7, *g-i*); in lateral view apical margin is very strongly reflexed at middle; lower apex of genital stem with several to many long and rather coarse bristles-----*chapini*, new species
- 23 (3). Tarsal claw definitely serrate (not pectinate) along two margins----- 24
- Tarsal claw serrate along only one margin (or hardly noticeably so at all)----- 25
- 24 (23). Front claws each with a strong tooth just before apex; thorax and base of elytra with very long, fine, erect hairs (genitalia fig. 10, *k, l, n*)-----*macmurryi*, new species
- Front claws with subapical enlarged tooth absent, or rarely present and then on outer claw only; head and thorax subglabrous (genitalia fig. 10, *i-j*)-----*wickhami*, new species
- 25 (23). Above densely pruinose, thorax apparently impunctate, or at least punctures hardly visible from above; glabrous except for elytra----- 26
- Pruinose or shining above, thorax usually punctate and shining (if pruinose then with long hair)----- 28
- 26 (25). Elytra with long and dense hairs; clypeus and front with erect hair on entire disk; first segment of hind tarsus strongly expanded (fig. 4, *d*) (genitalia fig. 9, *g-j*) *tarsalis* (Schaeffer)
- Elytra with minute, hardly visible hairs; clypeus glabrous; first segment of hind tarsus usually but little expanded, at most becoming gradually wider apically (note: a variable character; always check genitalia)----- 27
- 27 (26). First segment of hind tarsus strongly expanded just before the apex (fig. 4, *f*); thorax pruinose or not, puncturation always quite obvious; clypeus usually densely pilose (genitalia fig. 9, *a-c*)-----*falsa* LeConte (part)
- First segment of hind tarsus normal, not at all expanded toward apex; entire upper surface densely pruinose, the punctures of thorax hardly perceptible; clypeus nude or nearly so-----*falsa nogales*, new subspecies
- 28 (25). First segment of hind tarsus strongly expanded near apex, about twice as long as wide at apex; first segment of front tarsus with noticeable to large inner tooth----- 29
- First segment normal, apparently a little expanded but always about three to four times longer than width at apex; first segment of front tarsus without or with a very small inner spine----- 32

- 29 (28). Hind tibia with short sparse spines, these never more, and usually less, than one-third length of tibia; first segment of hind tarsus very suddenly widened at apex (fig. 4, f); hind tarsus sparsely hairy.....*falsa* (LeConte) (part)
Hind tibia with long, usually rather dense and fine hair on inner side, this hair often one-half as long as or longer than tibia; first segment of hind tarsus gradually widened from near base, and usually densely hairy, especially near base..... 30
- 30 (29). First segment of front tarsus with very long spinelike projection, width of segment at apex one-half or more its length (fig. 3, n), hind tarsus with first segment always expanded and from two to two and one-half times as long as wide..... 31
First segment of front tarsus with a small inner spine, width not more than one-third its length and usually less (fig. 3, l); hind tarsus with first segment usually but little expanded and not less than three times as long as wide at apex (genitalia fig. 9, k-n).....*flmbripes* (LeConte) (part)
- 31 (30). Aedeagus in lateral view with two teeth on lower margin (fig. 11, a-d).....*koehleriana*, new species
Aedeagus in lateral view with a single bluntly rounded lobe in place of the two approximate teeth (fig. 11, e-g).
neomexicana, new species
- 32 (28). Abdomen transversely tumid, often markedly so (fig. 2, c); hind tibia with moderately long and often rather dense and fine hairs (except in *parilis*)..... 33
Abdomen flat or nearly so (fig. 2, b); hind tibia with moderately coarse and sparse hairs, usually without long or fine hairs (except *peninsularis*)..... 35
- 33 (32). Thorax strongly pruinose; entire dorsal surface with moderately long and erect hair (genitalia fig. 11, h-k).
opacicollis (Horn)
Thorax shining, not pruinose; pilose above but thorax in great part glabrous, especially on disk..... 34
- 34 (33). Hind tarsus and tibia with thickened, almost spinelike hairs, without any long fine cilia; thorax and pygidium strongly shining (genitalia fig. 11, o-r).....*parilis* (Bates)
Hind tarsus and tibia with long, often dense, fine cilia; thorax and pygidium dull to moderately shining (genitalia fig. 9, k-n).....*flmbripes* (LeConte) (part)
- 35 (32). Elytra with very short and dense erect hairs; thorax very densely, coarsely, and entirely, punctate; clypeus trapezoidal, angles sharp and entire apical margin reflexed (genitalia fig. 3, h-i).....*peninsularis*, new species
Elytra with very sparse, short, procumbent hair, or glabrous; thorax moderately punctured; clypeus with angles noticeably rounded..... 36
- 36 (35). All claws with moderately strong submedian tooth..... 37
All claws without any larger intercalated tooth (except front outer claw in *texensis*)..... 39
- 37 (36). Thorax rufotestaceous, moderately sparsely punctate, with large median-impunctate area; lateral margins of

- thorax with long cilia; clypeal suture very faintly bi-arcuate; antennal club one-third longer than funicle..... 38
- Thorax rufous, densely punctate, with little or no trace of a median impunctate area; lateral margins of thorax with short cilia; clypeal suture strongly biarcuate, impressed; antennal club subequal to funicle (genitalia fig. 6, *i, j*,)..... **cushmani**, new species
- 38 (37). Sides of genitalia in *en face* view thickened near apex, not open to base through middle (fig. 6, *g, h*)..... **duncani** (Barrett)
- Genitalia in *en face* view thickened all along the median line and open through the middle (fig. 6, *e, f*).... **arizona**, new species
- 39 (36). All claws without a larger intercalated tooth; pygidium plane or very convex..... 40
- Outer front claw with a larger intercalated tooth, inner claw without such tooth; pygidium normally convex; sides of thorax subangularly dilated, margin very coarsely crenate (genitalia fig. 10, *m-o*)..... **texensis**, new species
- 40 (39). Pygidium very convex, densely and coarsely punctate and shining, with short procumbent hair; sixth abdominal segment plane (genitalia fig. 6, *k-n*)..... **scuticeps** (Bates)
- Pygidium plane, very sparsely and finely punctate, with minute hair, surface subopaque; sixth abdominal with a short and truncate lobe at middle (fig. 2, *b*)..... **senex** (Horn)

KEY TO THE FEMALES OF LISTROCHELUS

(The females of *L. cavata*, *neomexicana*, *cushmani*, *snowi*, and *duncani* are either unknown or, for reasons explained later, not included)

1. All tarsal claws serrate or pectinate along a single margin; without any intercalated larger teeth..... 2
- Claws variable, one or both of those of front tarsus with a much larger tooth among serrations or pectinations..... 4
- 2 (1). Glabrous above (Texas)..... **senex** (Horn)
- At least elytra densely hairy (Lower California)..... 3
- 3 (2). Claws pectinate; clypeus reflexed at center apex, angles broadly rounded..... **pilosipes**, new name
- Claws minutely serrate; entire clypeal apex strongly reflexed, angles very sharply indicated..... **peninsularis**, new species
- 4 (1). Thorax opaque, punctures not or hardly visible from a straight dorsal view; disk glabrous except at sides..... 5
- Thorax always distinctly punctured and usually highly polished; if opaque then with dense hairs..... 6
- 5 (4). Elytra with long dense hair; first segment of hind tarsus somewhat expanded at apex (fig. 3, *m*); first front tarsal segment with a strong inner spine, width of segment at apex one-half of its length..... **tarsalis** (Schaeffer)
- Elytra with minute hair, or glabrous; first segment of hind tarsus normal; first segment of front tarsus with a sharp but small inner spine, the width of segment at apex scarcely two-fifths its length..... **falsa nogales**, new subspecies
- 6 (4). Entire dorsal surface highly pruinose and densely hairy; pygidium convex, polished, not impressed..... **opacicolis** (Horn)

- Thoracic disk usually glabrous, if slightly hairy then
pygidial apex with a longitudinal impression..... 7
- 7 (6). Dorsal surface shining, rarely elytra pruinose; serration of
claws feeble to moderate; size 10–12 mm..... 8
- Dorsal surface and claws variable; size 13 mm. or more..... 10
- 8 (7). Form elongate, parallel; glabrous above or nearly so;
pygidium plane, very coarsely and densely punctate,
not impressed..... *timida* (Horn)
- Form robust-oval; elytra and head (at times thorax also)
hirsute..... 9
- 9 (8). Pygidium plane, finely punctate, not at all impressed;
elytra pruinose..... *arizona*, new species
- Pygidium polished, finely punctate, apical third with a
deep longitudinal impression; elytra shining... *macmurryi*, new species
- 10 (7). Pygidium flat or nearly so in basal three-fourths and usu-
ally densely pruinose, with at least the apical fifth always
raised slightly to strongly, and usually polished; dorsal
surface usually, or quite frequently, pruinose (note: the
Lower California *miraflores* of the following couplet has
the basal half of the pygidium pruinose and slightly con-
vex, the apical half highly polished and evenly convex,
the center disk thus slightly foveate)..... 11
- Basal half at least of pygidium always convex, usually
noticeably so, if at all flattened then surface smooth,
highly polished, and without an apical raised portion..... 16
- 11 (10). Pygidial apex very strongly gibbose (especially in lateral
view) and surface very coarsely rugose, with dense, short
hairs; claws serrate along a double margin..... *scoparia* (LeConte)
- Pygidial apex variable, not at all gibbose, usually smooth
and polished, and densely pruinose..... 12
- 12 (11). Pygidium strongly flattened and polished in apical third to
half, with a definite longitudinal impression in polished
area; large intercalated tooth of tarsal claws always
nearly apical in position; inner hind tarsal claws without
a larger intercalated tooth..... 13
- Pygidium not flattened apically, the polished raised area at
and before apex polished but transverse (fig. 8, *m-o*) and
without any impressed line, large tooth of claws median
in position; hind claws each with a strong median tooth..... 14
- 13 (12). Pygidium with basal hairs short and inconspicuous; apical
fourth very highly polished and sparsely, finely punctate,
the latter area glabrous or nearly so..... *pulcher* (Linell)
- Pygidium more densely pruinose and hairy in basal three-
fourths, hairs a little longer; apical fourth less highly
polished, more densely punctate, with short hairs.
mucorea (LeConte)
- 14 (12). Lateral thorax margins behind median dilation straight or
nearly so; form robust and surface usually shining;
pygidium with raised smooth area in apical sixth only
and this area not strongly V-shaped (fig. 8, *m*)..... *disparilis* (Horn)
- Thorax sinuate behind dilation; form elongate and sub-
parallel, surface usually moderately to densely pruinose;

- raised smooth area of pygidium occupying apical third,
or if in apical sixth only, then strongly V-shaped..... 15
- 15 (14). Apical sixth of pygidium raised, polished, and strongly
V-shaped (fig. 8, *n*)..... *huachuca*, new species
- Apical third of pygidium raised, polished and only very
slightly V-shaped, at times somewhat irregular in out-
line (fig. 8, *o*)..... *chapini*, new species
- 16 (10). Base of clypeus transversely raised, usually very coarsely
punctate; larger intercalated tooth subapical in position
(Lower California)..... 17
- Clypeus never gibbose, always plane, puncturation variable
(United States)..... 20
- 17 (16). Pygidium in lateral view with basal half slightly convex
and highly pruinose, apical half highly polished, evenly
and strongly convex, and center disk with a small shallow
fovea; front flat, not rugose, rather sparsely punctate;
thorax densely, not rugosely, punctate; elytral hair very
short and scarcely obvious; dorsal genital plate deeply
concave before apex and center base prolonged into a
blunt, semierect lobe (figs. 13, *e-f*)..... *mirafloza*, new species
- Pygidium variable, but not as above; front coarsely punctate and usually coarsely rugose; thorax rugosely punctate or not; elytral hair longer and more obvious than in *mirafloza*; dorsal genital plate smooth or at most transversely impressed before apex and usually incompletely so..... 18
- 18 (17). Pygidium convex at base, apical half strongly flattened to faintly concave and smooth; dorsal genital plate in lateral view suddenly declivous just before apex (fig. 13, *a-b*); thoracic disk densely punctate but never rugose, highly polished..... *micelbacheri*, new species
- Pygidium variable, not as above; dorsal genital plate in lateral view without subapical declivity or latter, if present, always very indefinitely indicated; thoracic disk rugose or not..... 19
- 19 (18). Thorax densely punctate, never rugose; dorsal genital plate in lateral view always smooth (figs. 13, *g-h*); pygidium variable, center of disk always gibbose and frequently gibbosity slightly to moderately flattened at middle, at times with a trace of a longitudinal sulcus.
- carminator* (Horn)
- Thorax always coarsely rugose; dorsal genital plate usually with a fine, incomplete, subapical impression, rarely entire plate smooth (figs. 13, *c-d*); pygidium highly variable, varying from faintly convex, with center disk flattened, to center disk faintly concave to moderately foveate, or even longitudinally sulcate at middle; disk never so convex at middle, however, as in *carminator*..... *densicollis* (LeConte)
- 20 (16). Pygidium highly polished, very finely punctate, glabrous; apex explanately prolonged into two rounded toothlike lobes, separated by a narrow U-shaped notch..... *micros* (Bates)
- Pygidium not exactly as above..... 21

- 21 (20). Pygidium polished, finely punctate, nearly glabrous (except under high power); apex gibbose and slightly overhanging itself in lateral view, apical margin with two small and very obtuse teeth, separated by a broad and shallow emargination (fig. 4, c).....**meadei**, new species
Pygidium not exactly as above..... 22
- 22 (21). Apex of fifth abdominal segment with a broad and moderately deep emargination; pygidial disk and dorsal surface highly polished; larger tarsal tooth subapical in position.....**cochisa**, new species
Apex of fifth abdominal segment entire, not at all emarginate..... 23
- 23 (22). Larger teeth of front tarsal claws subapical in position; elytra densely pruinose..... 24
Teeth of front tarsal claws always median in position or nearly so; pruinosity variable..... 25
- 24 (23). Pygidium and thorax highly and entirely polished, not at all pruinose; inner hind tarsal claw usually with a larger intercalated tooth (this frequently worn) (Arizona).....**plena** (Fall)
Pygidium and thorax always pruinose, at least in part; inner hind tarsal claw always without a larger tooth (Texas).....**reinhardi**, new species
- 25 (23). Pygidium noticeably flattened and densely hairy, basal half pruinose, disk densely, coarsely, and rugosely punctate, apex broadly rounded; elytra with moderately long to short, erect hairs (Arizona).....**trochanter**, new name
Pygidium variable, never as above..... 26
- 26 (25). Base of clypeus noticeably tumid, pygidium flat to slightly convex, surface coarsely rugose, slightly polished and with dense short hairs, apex with coarse spines, all claws subpectinate along a double row (Arizona).....**granti**, new species
Base of clypeus flat, pygidium convex, surface polished, pilosity absent or present..... 27
- 27 (26). Thorax more than twice as wide as long, lateral margin behind median dilation straight or slightly sinuate; center base of pygidium with slight but noticeable fovea at point of juncture with propygidium; elytra always at least slightly pruinose..... 28
Thorax scarcely twice as wide as long, lateral margins straight or nearly so posteriorly; center base of pygidium not impressed; elytra and dorsal surface shining to slightly pruinose..... 31
- 28 (27). Pygidium broadly rounded to semirounded apically, disk strongly convex; thoracic disk never with hair except at sides; first hind tarsal segment frequently much wider at apex.....**falsa** (LeConte)
Pygidial sides noticeably convergent apically, apex truncate, usually markedly so; usually with at least some hair on disk, at times this rubbed off..... 29
- 29 (28). First front tarsal segment with a strong inner spine, width of segment at apex nearly one-half total length (fig. 3, n); elytral area near suture with moderately dense, long, erect hairs (New Mexico).....**koehleriana**, new species

- Front tarsal spine weak, the width of segment at apex about a third of total length (fig. 3, *l*); long hairs on elytra variable, dense or not..... 30
- 30 (29). Pygidium and propygidium moderately finely and regularly punctate, with short erect hairs; sides of thorax behind median dilation nearly straight; thorax moderately densely and not finely punctate..... *fimbripes* (LeConte)
- Pygidium and propygidium more sparsely and finely punctate, hair if present hardly noticeable; thorax behind middle slightly sinuate, thoracic disk very finely and not densely punctate..... *parilis* (Bates)
- 31 (27). Pygidium convex and with moderately dense short hairs; claw serrate along a single margin; lateral thoracic margins very coarsely crenate, disk very convex (Texas and Mexico)..... *scuticeps* (Bates)
- Pygidium variable, with at most very short and sparse hair..... 32
- 32 (31). Pygidium moderately convex, very highly polished, and very finely punctate; abdominal hairs moderately dense at center and of moderate length; all claws serrate to subpectinate along a double margin; entire lateral thoracic margin coarsely crenate (Arizona and New Mexico)..... *flavipennis* (Horn)
- Pygidium flat to slightly convex, highly polished, and finely punctate; abdominal hairs very fine and hardly obvious; all claws serrate along a single margin..... 33
- 33 (32). Lateral thoracic margins behind median dilation entire; front extremely densely and coarsely punctate; clypeal angles narrowly rounded; prevailing color dark piceo-castaneous..... *texensis*, new species
- Lateral thoracic margins behind the dilation crenate; front densely to sparsely punctate; clypeal angles broadly rounded; prevailing color rufocastaneous to rufotestaceous..... *wickhami*, new species

Genus PHYLLOPHAGA Harris

Subgenus LISTROCHELUS Blanchard

PHYLLOPHAGA (LISTROCHELUS) MIRAFLORA, new species

FIGURES 5, *i-n*; 13, *e-f*

Male.—Elongate, head and thorax strongly shining, elytra strongly pruinose, with short, sparse, scarcely noticeable hair, otherwise glabrous above. Color rufocastaneous to rufopiceous, the thorax usually the darkest. Clypeus flat, base rarely a little elevated but never gibbose, disk closely and moderately coarsely punctured; apex subtruncate, faintly to slightly reflexed, sides nearly straight, the angles narrowly rounded. Front flat, sparsely to moderately densely punctate, not rugose. Antenna 10-segmented, club of lighter color than the funicle and subequal to the latter in length. Prothorax regularly punctate, the punctures separated by one to one and one-

half times their diameters on the disk, the punctures somewhat closer at sides and along the frontal margin; basal margin entire; front angles strongly rounded, hind angles obtuse, lateral margins entire or faintly crenulate. Elytra finely, not densely, punctate, with striae subobsolescent in basal half, sutural stria normal; in a few specimens there is a weakly indicated second stria. Pygidium strongly and evenly convex, basal half or third pruinose, the apical portion highly polished; disk sparsely and finely punctate, with very short erect hairs. Abdomen flattened at middle and finely sparsely punctate; sixth segment longer than the preceding, flattened nearly from side to side, the flat area with fine scabrose punctures and very short, sparse, and erect hairs. All claws strongly pectinate along a single margin, without any larger intercalated teeth. First segment of hind tarsus shorter than the second. Larger hind tibial spur usually one-fourth longer than the first tarsal segment.

Female.—Antennal club slightly shorter than the funicle; pygidium convex and pruinose in basal half, apical half strongly convex and highly polished, the center disk with a small, shallow foveate area; abdomen highly polished at middle, subconvex in lateral view, the apical segment moderately densely and finely punctate. All claws pectinate along a single margin and each with a subapical, larger, intercalated tooth. Otherwise similar to the male.

Length.—13–17 mm. *Width*.—5.5–6.5 mm.

Types.—The holotype male is from “5 miles S. of Miraflores, Lower California, collected VII–10–38 by Ross and Michelbacher”; the allotype female is from “Miraflores, collected VII–8–38” also by Ross and Michelbacher; both types are in the California Academy of Sciences.

Paratypes: LOWER CALIFORNIA: 2 from Miraflores; 21 from Triunfo, July 7, 1938 (Ross and Michelbacher), and from 6 miles north of Triunfo, July 15, 1938; 2 from 5 miles west of San Bartola, July 13, 1938 (Ross and Michelbacher). Designated paratypes are in the collections of the California Academy of Sciences, the United States National Museum (No. 53758), Messrs. Ross and Michelbacher, Mont Cazier, and in the Saylor collection.

Remarks.—This interesting species at first glance resembles those of the *densicollis* complex very closely, but the key characters will readily separate the various species concerned. The male genitalia of the present species are asymmetrical and tend toward the more tubular type but are still somewhat similar to those of *densicollis*; in the female *miraflorea* the dorsal genital plate has been modified considerably though still maintaining the basic type of the *densicollis* group.

There is considerable variation in the male genitalia, each type of small variation being limited, however, to one general region (see fig. 5, *i-n*); since these variations are only in degree and since there appears to be no other internal or external differences, I believe this aggregation of specimens is better treated as a single variable species.

PHYLLOPHAGA (LISTROCHELUS) DENSICOLLIS (LeConte)

FIGURES 5, *e, f*; 13, *c, d*

Listrochelus densicollis LECONTE, Smithsonian Misc. Coll., vol. 6, No. 167, p. 77, 1863.—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 143, 1878.

Male.—Elongate, wider behind, elytra rather dull brown and moderately densely pruinose; thorax and head rufopiceous, moderately shining. Head glabrous, coarsely, rugosely, and densely punctate; transverse carina of vertex rather noticeable; clypeus very tumid at center of base, the tumosity densely and coarsely punctured; apex of clypeus subtruncate, very slightly emarginate, the angles narrowly rounded, margins but little reflexed; front very coarsely and closely punctate. Antenna 10-segmented, the club very slightly longer than the funicle. Prothorax densely, subrugosely, and (in front) coarsely punctured, lateral margins with long cilia, the margin in front of the median lateral dilation coarsely crenate, that behind the dilation entire; hind angles subangularly rounded, the front angles noticeably rounded; front and basal margins strong and entire. Elytra punctured as thorax, with short, inconspicuous, yellow hairs in the punctures; striae, except the sutural, hardly obvious. Pygidium very convex, strongly shining, with fine, moderate-sized, and dense punctures and with short, scattered, and suberect hair; apex subrounded. Abdomen flattened at middle, polished, sparsely pilose; fifth segment shorter than fourth, plane; sixth segment rather large, strongly convex, and with a very large and broad, moderately deep fovea in the middle, the surface with sparse, moderately long, and erect hair. All claws pectinate along a single margin, the pectinations large and of uniform size; first segment of hind tarsus much shorter than the second, hind tarsus scarcely longer than its tibia. Genitalia as in figure 5, *e, f*.

Female.—Antennal club three-fourths the length of the funicle; elytra markedly pruinose. Pygidium convex, moderately densely punctate, with short erect hairs; disk pruinose in basal half and polished in apical portion, the apical margin slightly explanate (the disk in the apical half is more densely punctate, and either tumid or faintly and longitudinally impressed at the center). Abdomen polished, slightly convex; sixth segment slightly convex, moderately densely and setigerously punctate. All claws subpectinate along a single margin, with a large triangular tooth beyond the middle (i. e.,

subapical). Genitalia as in figure 13, *c*, *d*. Otherwise similar to the male.

Length.—15–16.5 mm. *Width*.—7–8 mm.

Type.—Female, from Cape San Lucas, in the LeConte collection.

Specimens examined.—Males, 116; females, 74. LOWER CALIFORNIA: San Felipe, August (Beyer) [U.S.N.M.] and [Robinson]; Santa Rosa [U.S.N.M.]; 6 miles north of Triunfo, July 15, 1938 [Ross and Michelbacher]; Triunfo, July 15, 1938; San Bartola, July [Saylor]; 5 miles west of San Bartola, July 13, 1938 [Ross and Michelbacher]; 3 miles north of San Pedro, July 6, 1938 [Ross and Michelbacher].

Remarks.—The majority of the specimens are those collected by Ross and Michelbacher and are the first adequate series ever assembled for study; previously the species was known in the major collections of the country by less than two dozen specimens. The pygidium of the female varies somewhat within the species and may be evenly convex or convex and slightly and longitudinally impressed.

PHYLLOPHAGA (LISTROCHELUS) CARMINATOR (Horn)

FIGURES 5, *a-c*; 13, *g, h*

Listrochelus carminator HORN, Proc. California Acad. Sci., ser. 2, vol. 4, p. 398, 1894.

Male.—Very similar in most respects to *densicollis*, differing most conspicuously as follows: Thoracic disk less densely punctate and usually with an impunctate area; transverse clypeal carina less densely punctate. The genitalia in an *en face*-dorsal view are slightly to strongly expanded outwardly, while the upper tooth as viewed laterally is fairly short, as is shown in figure 5, *b, c*.

Female.—Essentially the same as in *densicollis*, but with the thorax densely punctate and never rugosely so; the dorsal genital plate in lateral view is always smooth. The pygidium is variable, with the center of the disk always gibbose, frequently the gibbosity slightly to moderately flattened at the middle and at times with traces of a longitudinal sulcus. Genitalia as in figure 13, *g, h*.

Length.—15–17 mm. *Width*.—7–8 mm.

Type.—Male, from "San Jose del Cabo," in the Horn collection.

Specimens examined.—Males, 24; females, 25. LOWER CALIFORNIA: Santa Rosa [U.S.N.M.]; San Felipe, July 10, 1938; Santiago on July 8, 1938, and 10 miles southwest of San Jose del Cabo on July 9, 1938 [all Ross and Michelbacher].

Remarks.—Closely allied to *L. densicollis* but separable by the key characters. The very short upper tooth of the male genitalia is a

good distinguishing character. The rugosity of the thorax varies somewhat in *carminator*, as well as in *densicollis* and *micelbacheri*, but most specimens will readily fall into the proper couplets in the keys.

PHYLLOPHAGA (LISTROCHELUS) MICELBACHERI, new species

FIGURES 5, *g*, *h*; 13, *a*, *b*

Male.—Very similar in all characters to *carminator*, except as follows: The genitalia in lateral view (fig. 5, *g*, *h*) have the upper and lower teeth of approximately the same size, while in *en face*-dorsal view the genitalia are expanded outwardly toward the sides, and the upper teeth are much longer than in *carminator*.

Female.—Exactly similar to *carminator*, except that the pygidium is convex at the base, with the apical half strongly flattened to faintly concave, and smooth. In lateral view the dorsal plate of the genitalia (fig. 13, *a*, *b*) is suddenly declivous just before the apex. The thoracic disk is densely punctate and highly polished, but never rugose.

Length.—14–17 mm. *Width*.—7–8 mm.

Types.—Holotype male and allotype female are from "20 mi. N. of Comondu, Lower California, collected VII-23-38 by Ross and Michelbacher" and are in the California Academy of Sciences. Paratypes are in the collections of the California Academy of Sciences, U. S. National Museum (No. 53759), Messrs. Ross and Michelbacher, Mont Cazier, and in the Saylo collection. Named in honor of the collector, Dr. Abe Michelbacher, of the University of California, Department of Entomology.

Paratypes: Males, 61; females, 30. LOWER CALIFORNIA: 20 miles north of Comondu, July 23, 1938; 15 miles west of La Paz, July 5, 1938; Venancia, July 17, 1938; 15 miles west of San Ignacio, July 26, 1938; San Domingo, July 19, 1938; 15 miles north of El Refugio, July 4, 1938; 12 miles south of Santa Rosalia July 27, 1938; and 25 miles south of San Rosalia, July 25, 1938 (all Ross and Michelbacher); Palmarita, September 1923 (Wm. Mann) [U.S.N.M.].

Remarks.—The pygidium of the female is very characteristic and will set off this sex immediately from the others of the complex. The male is most readily distinguished by the use of the genital characters since the external characters are close to those of *carminator* and *densicollis* and are less obvious without careful study.

PHYLLOPHAGA (LISTROCHELUS) PILOSIPES, new name

FIGURE 11, *l-n*

Listrochelus puberulus LECONTE, Smithsonian Misc. Coll., vol. 6, p. 78, 1863 (homonym of *puberulus* du Val, 1851).—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 142, 1878.

Male.—Robust-oval, much wider behind, entire dorsal surface moderately shining and with dense, very short, and erect hairs. Head very densely, coarsely, and rugosely punctate, the transverse carina of the vertex sharply defined, the surface posterior to the carina with dense, moderately coarse, and transverse tumosities; clypeal suture nearly straight, clypeus nearly hexagonal, apex truncate and very strongly reflexed, sides straight and strongly convergent apically, the angles narrowly rounded. Antenna 10-segmented, club two-thirds the length of the funicle. Thorax punctured like head but more densely so; lateral margins with long, dense cilia, and the entire margin finely crenulate; hind angles obtuse, front angles subrounded; base and apex with a strong and entire marginal line. Elytra punctured as thorax. Pygidium convex, pruinose, densely and moderately coarsely punctate, with moderately long erect hair. Abdomen flattened, subpruinose, with moderately dense hair; fifth segment twice the length of the sixth and very densely setigerously punctate; sixth segment very slightly convex, rugosely and setigerously punctate. All claws pectinate along a single margin. First segment of hind tarsus equal in length to the second.

Female.—Length of the antenna and all other characters are practically the same as in the male except that the abdomen is somewhat more convex.

Length.—12.5–15.5 mm. *Width*.—6.5–7. mm.

Type.—From "Cape San Lucas, Lower California," in the LeConte collection.

Specimens examined.—Males, 13; females, 12. LOWER CALIFORNIA: Santa Rosa [U.S.N.M. and Robinson]; Triunfo, July 13, 1938 (Ross and Michelbacher); Miraflores and San Bartola, July 10–13, 1938 (Ross and Michelbacher).

Remarks.—Known only from Lower California and uncommon in collections. Not close to any other species of the genus in either external characters or male genitalia except the new species *L. peninsularis*, described herein.

The specimens from Triunfo are more sparsely pubescent on the abdomen than are those from either Miraflores or San Bartola, but the genital and other characters appear to be essentially similar in all the specimens.

PHYLLOPHAGA (LISTROCHELUS) PENINSULARIS, new species

FIGURE 3, h, i

Male.—Small, wider behind, above with sparse and short erect hair, that of the thorax minute; color rufocastaneous and shining, the thorax more rufous. Head with entire surface of front coarsely and variolately punctate; transverse carina of the vertex very sharply .

defined, the surface behind the carina sparsely punctate and much more sparsely so at the occiput; clypeal sulcus nearly straight, not impressed; clypeus nearly trapezoidal in shape, sides straight and convergent apically, apex sharply and markedly reflexed, truncate, the angles very narrowly rounded; clypeal disk flat, slightly less densely punctured than the front. Antenna 10-segmented, rufotestaceous, the club testaceous and very slightly longer than the funicle. Thorax subangulately dilated at about the middle of the lateral margins, the margin ciliate and slightly crenulate; front and hind angles well defined but obtuse; disk coarsely and densely punctate, the punctures closer near sides and front margins, with a small mediobasal impunctate area. Elytra very coarsely, not densely, but regularly punctured, striae except the sutural not obvious. Pygidium convex, semipruinose, entire surface coarsely and moderately densely punctate, with moderately long erect hair; apex ciliate and subtruncately rounded. Abdomen polished and somewhat flattened at middle, sparsely punctured with erect hair; fifth segment moderately densely and piliferously punctate; sixth shorter than fifth, moderately densely and somewhat coarsely punctate. All claws very finely, hardly noticeably serrate along a single margin, with no larger intercalated teeth.

Female.—Very similar to male in all respects except that the antennal club is slightly shorter than the funicle and the abdomen in lateral view is slightly convex instead of flattened.

Length.—10–11 mm. *Width*.—5–5.5 mm.

Types.—Holotype male and allotype female from "Purissima, Lower California, collected October 23 by W. M. Mann," are in the United States National Museum (No. 53760). Paratypes: One female, same data, in the Saylor collection.

Remarks.—This new species shows the slightly asymmetrical male genitalia characteristics of the Lower Californian *L. pilosipes* Saylor, and the two together form a group that can be confused with no other species groups in the genus; the dense short hair and coarse puncturation of the entire dorsal surface as well as the asymmetrical male genitalia readily characterize the group.

PHYLLOPHAGA (LISTROCHELUS) TROCHANTER, new name

FIGURES 2, c; 4, a; 9, d–f

Listrochelus gracilis HORN, Trans. Amer. Ent. Soc., vol. 12, p. 123, 1885 (pre-occupied by Burm, 1855, and Nonfried, 1891).

Male.—Oblong-oval, sides somewhat subparallel. Head and thorax shining rufous, elytra and legs rufocastaneous, the former moderately pruinose. Head densely, not coarsely punctured, glabrous, the clypeal suture not impressed; transverse carina of vertex sharp and

conspicuous; clypeal apex subtruncate, rather strongly reflexed, angles rather broadly but not suddenly rounded. Antenna 10-segmented (rarely 9-segmented), the club about subequal to funicle. Thorax highly polished, finely, densely, and regularly punctured; sides with long cilia, and crenulate in front of the median dilation only; hind angles angularly rounded, front angles slightly rounded; front and basal marginal lines strongly indicated. Elytra punctured as thorax but less densely so, with moderately long and suberect hairs; costae, except sutural, obsolete. Pygidium very convex, polished, sparsely and finely punctate, with very short and erect hair. Abdomen flattened, and moderately densely, but finely, subgranulate at center; fifth segment equal in length to fourth; sixth three times the length of the fifth, raised rather conspicuously at each side into a prominence that forms the side of the very wide and sharp transverse carina, the latter slightly curved and extending practically from side to side of the segment, the remainder of the sixth segment flattened, polished, and very finely, sparsely punctate. All claws subpectinate along two margins, the front outer claws alone having a larger triangular tooth near the apex. Hind trochanter strongly prolonged behind the femur into a spinelike projection (fig. 4, *a*). First segment of hind tarsi longer than the second, all hind tarsal segments except the last with very dense hair below.

Female.—More robust, thorax more rufopiceous. Antenna three-fourths the length of the funicle. Pygidium flattened to slightly concave at center, pruinose and densely, finely punctate in basal two-thirds and highly polished and more coarsely punctate apically; surface with dense, erect, moderately long hairs; disk just before apex faintly tumid. Claws serrate along two (high power, 20 \times) margins, with a moderately large triangular tooth at the center of each, the inner claw of the hind tarsi, however, with the median larger tooth absent. Hind trochanter hardly produced. Otherwise similar to male.

Length.—13.5–17 mm. *Width*.—6–7 mm.

Type.—From "Arizona," in the Horn collection.

Specimens examined: Males, 26; females, 11. ARIZONA: Seen from a rather limited area in the southeastern part of the State, embracing Graham (Oracle), Pima (Tucson), Cochise, and Santa Cruz (Nogales) Counties; July and August.

Remarks.—Easily distinguished in the male sex by the strongly produced hind trochanters and the abdominal armature, which have no counterpart in the described species of the genus. This species, together with *L. scoparia* LeConte, *L. gentryi* Saylor, and *L. terminalis* Saylor, forms a group of the genus having in the males oddly formed fifth abdominal segments and densely pilose hind tarsal segments; in

the latter character the group approaches the subgenus *Chlaenobia*, though the tarsal claws in the two subgenera are of course quite dissimilar. The present species varies somewhat in the number of antennal segments but this is not at all uncommonly met with especially in the more typical members of the genus (*Phyllophaga sensu stricto*).

PHYLLOPHAGA (LISTROCHELUS) SCOPARIA (LeConte)

FIGURES 2, d; 3, g; 4, b, e; 7, e, f

Listrochelus scoparius LECONTE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, p. 264, 1856.—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 142, 1878.—BATES, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 173, 1888.

Male.—Oblong-oval, rufocastaneous, thorax more rufous; elytra slightly to markedly pruinose, with scattered pile. Head with a strong transverse carina on the vertex, front densely, moderately finely punctate; clypeus longer than front, less densely punctured; apex slightly reflexed, subtruncate and faintly emarginate, angles narrowly rounded. Antenna 10-segmented, club slightly longer than, or subequal to, the funicle. Labrum deeply bilobed. Thorax finely, regularly, and moderately densely punctured, glabrous except for a few minute hairs near basal margin; angles rounded in front, obtuse behind; lateral margins ciliate, coarsely crenulate, less so in basal half; base and apex both strongly margined. Elytra punctured as thorax, with moderately sparse, short, erect hairs; striae except sutural not evident. Pygidium strongly convex, finely, moderately densely punctured, with short suberect hairs; surface somewhat pruinose; apex wide and truncate, apical margin thickened. Abdomen with segments 1–5 inclusive flattened at middle and sparsely, finely punctured and pubescent; fifth segment with a small, triangular-shaped, elevated, plateaulike area beginning in apical half and continuing to the apical margin; sixth segment much larger than fifth, with a very strong transverse carina at middle, the carina deeply incised and forming at its ends two strong toothlike lobes, surface in basal half of sixth sparsely punctured, nonpilose, that of apical half moderately densely punctate and with rather long, erect hair. Hind tarsus only as long as the tibia and rather densely pilose below. Hind tibia somewhat more densely pilose on the inner side than in most of the species of the subgenus. All claws pectinate on a double margin, without larger intermixed teeth.

Female.—Antennal club shorter than funicle. Pygidium flat in basal two-thirds, abruptly gibbose in apical third, the latter very coarsely and rugosely punctured, and polished; basal area highly pruinose, with dense and fine punctures, and moderately long, erect hair; pygidial disk in lateral view appearing rather concave. Abdomen

highly polished and evenly convex at middle, with fine and sparse setigerous punctures, the sixth and apical portion of the preceding segment slightly more coarsely punctate. All claws except the inner hind one with a sharp median tooth intercalated with the serrations, which occur in a double row; hind inner claw serrate but without the larger intermixed tooth. Hind tarsus only slightly pilose below. Otherwise similar to male.

Length.—13–17.5 mm. *Width*.—5.5–9 mm.

Type.—In the LeConte collection.

Type locality.—"Sonora, near the Boundary line."

Specimens examined.—Males 97; females, 63. ARIZONA: The range is rather general over the southern half of the State south of Prescott. June 6 (Sabino Canyon) to middle August (Buckeye). Taken on *Olneya tesota* (desert ironwood) by Ernest Holt at Higley.

Remarks.—This very distinct and common species can be distinguished in either sex probably more easily than any other of the group; the unusual abdominal armature and hairy hind tarsi of the male, as well as the pygidial characters of the female, are unique in the United States fauna. The male in abdominal armature is closely related only to the Mexican species *L. terminalis* Saylor and *L. gentryi* Saylor.

PHYLLOPHAGA (LISTROCHELUS) DISPARILIS (Horn)

FIGURES 1; 6, *a-d*; 8, *m*

Listrochelus disparilis HORN, Trans. Amer. Ent. Soc., vol. 7, p. 141, 1878.

Male.—Elongate, subparallel, rufocastaneous, shining above, with or without faint pruinose markings on elytra. Head with transverse carina strong; front flat, densely, coarsely, and not confluent punctate, glabrous; clypeal suture fine, subarcuate, not impressed; clypeus punctured as front but much more densely so at center of disk; apex of clypeus subtruncate, angles moderately rounded, the margins slightly reflexed; clypeus as long as the front. Labrum very deeply, widely, semicircularly emarginate. Antenna 10-segmented, club small and slightly longer than funicle. Thorax broad, moderately densely, finely, irregularly punctured, more closely so at sides, disk glabrous; base and apex with strong marginal lines, lateral margins ciliate and coarsely crenate; hind angles nearly rectangular, front angles slightly obtuse but distinctly angulate. Elytra punctured as thorax but less densely so, first and second striae weakly indicated, sutural striae strong; surface of elytra with sparse, short, suberect hairs; lateral margin with long cilia. Pygidium strongly convex, highly polished, very finely, moderately densely punctate, with very short suberect hairs; apex truncate and broad. Abdomen very shallowly, widely, and longitudinally channeled at center, surface moderately

densely punctate at center, with short suberect bristles; fifth segment one-third longer than fourth; sixth segment a little shorter than fifth, with a deep longitudinal median sulcus, surface finely punctate, with short erect hairs, sides with numerous small, transverse, and scabrous filelike elevations. Hind femur with a single transverse submarginal line of 8 or 9 strong spines set in punctures. All tarsal claws strongly pectinate along a double margin, without larger intercalated teeth. First segment of hind tarsus longer than the second.

Female.—Antennal club shorter than funicle. Pygidium slightly convex and pruinose basally and somewhat concave and polished apically; apical margin a raised smooth area in the shape of a very wide-mouthed V and punctured near apex; entire disk with fine dense punctures, each with a short erect hair; disk just basad of the apical raised area somewhat rugose. Abdomen convex, highly polished and sparsely, finely punctate at middle; fifth segment depressed in apical fourth; sixth nearly as long as the preceding, flattened, with moderately coarse and dense setigerous punctures. All claws with a strong median tooth, the surface each side of the tooth serrate to subpectinate along a double margin. Otherwise similar to male.

Length.—16–20 mm. *Width*.—7–9 mm.

Type.—In the Horn collection in Philadelphia.

Type locality.—"Colorado, New Mexico, and Arizona."

Specimens examined.—Males, 21; females, 23. ARIZONA: Central and eastern portions of the State, especially in the Flagstaff and Prescott areas, July and August. COLORADO: Custer County (Cockerell) [U.S.N.M.]. NEW MEXICO: Frequent around Las Vegas and the central areas of the State and seen also from Cloudcroft, August; Jemez Mountains on July 24 at 9,000 feet [Calif. Academy]. MEXICO: "Mexico" [Casey and Saylor].

Remarks.—A wide-ranging species that cannot be easily confused with any other United States species except possibly in the female of *L. huachuca* and *L. chapini*; these latter two are easily separated by their much less robust form, much denser pruinosity, and the pygidial characters as given in the keys. The Mexican specimens are noticeably hairier on the elytra in both sexes but are not otherwise different from the United States specimens.

PHYLOPHAGA (LISTROCHELUS) HUACHUCA, new species

FIGURES 7, a–d; 8, n; 13, i

Male.—Strongly elongate, rufocastaneous, highly polished except for the densely pruinose elytra; head and thorax glabrous. Head with very dense and coarse variolate punctures; clypeal apex hardly reflexed, subtruncate, the angles broadly rounded; transverse carina of the vertex moderately strongly indicated, surface behind the latter

impunctate. Antennal club equal to funicle. Thorax with fine, dense, and regularly placed punctures; lateral margin coarsely crenate, with long cilia; disk with a small, longitudinal impunctate area at middle. Elytra with fine and dense punctures and apparently much smaller punctures intermixed, the hairs small to minute on disk, a little longer near and at the sides; striae, except sutural, obsolete. Pygidium strongly convex, with fine and sparse punctures, the hairs short and erect; apical part highly polished and less densely punctate, basal half pruinose or subpruinose. Abdomen flattened and slightly concave at middle, with dense, short erect hairs; sixth segment coarsely and rugosely punctate, with long erect hairs, with a rather deep median longitudinal sulcus, the area each side of middle with an oblique raised ridge on each side. All claws strongly pectinate along a double margin, without larger intermixed teeth.

Female.—Antennal club shorter than funicle. Base of clypeus somewhat tumid. Pygidium convex, densely pruinose in basal three-fourths, with fine, sparse punctures, and short, erect hair; apex with a strong, raised, and smooth V-shaped area. Abdomen slightly convex, polished, with fine, sparse, setigerous punctures; sixth segment as long as preceding but more densely and coarsely punctate and the hairs longer and more coarse. All claws serrate or subpectinate along a double margin, and each claw with a large, triangular median tooth. Otherwise as in male.

Length.—17–20 mm. *Width*.—7.5–8 mm.

Types.—Holotype and allotype are from the Huachuca Mountains, Carr Canyon, Arizona, collected by M. A. Cazier on June 14, 1936 (Saylor collection) and are deposited in the United States National Museum (No. 53761).

Paratypes.—Males, 14; females, 12. ARIZONA: Huachuca Mountains, July [U.S.N.M.], July 14 (Cazier) [Saylor]; June (Duncan) [Saylor] and July 8 (Beamer) [Snow Museum]; Santa Rita Mountains, July 24 (L. Anderson) [Snow Museum]; Chiricahua Mountains, June (Wickham) [U.S.N.M. and Saylor]; Ramsey Canyon, Huachuca Mountains (Cochise County) July [Saylor]. MEXICO: Ciudad Juarez, Chihuahua [Saylor].

Remarks.—While closely allied to *L. disparilis* Horn, *L. huachuca* is readily separated by the more elongate form and pruinosity of the dorsal surface (elytra), as well as by other structural and genitalic characters as shown in the keys. The form of the female pygidium in the three allied species (*L. disparilis*, *L. huachuca*, and *L. chapini*) is but slightly variable within each species and is of much assistance in separating specimens of this sex from one another.

PHYLLOPHAGA (LISTROCHELUS) CHAPINI, new species

FIGURES 7, g-j; 8, o

Male.—Very similar in all respects to *L. huachuca* Saylor, differing mainly in the genital characters. The area at the base of the clypeus is usually slightly to noticeably tumid in both sexes, while it is usually more flattened in *L. huachuca*.

Female.—Apical portion of the pygidium consisting of a large, smooth, and raised area in the shape of a very wide V, and is almost semicircular (fig. 8, o), whereas in *L. huachuca* the raised smooth area is a narrow, V-shaped area.

Length.—16.5–19 mm. *Width*.—7–8 mm.

Types.—Holotype and allotype are from "Fort Grant, Arizona, collected July 22 by Hubbard and Schwarz" and are in the United States National Museum (No. 53762).

Paratypes: Males, 26; females, 11. ARIZONA: Fort Grant [U.S.N.M. and Saylor]; Chiricahua Mountains, July [U.S.N.M.], July 13 (Van Dyke), June 10 [Saylor], and July 10 [Saylor]; Pinery Canyon, Chiricahua Mountains, 6,000 feet, July 1 [American Museum]; mouth of Rucka Canyon, Chiricahua Mountains, July 7 (Van Dyke). NEW MEXICO: "New Mexico" [U.S.N.M.]; Silver City, July 22 (Jackson) [Snow Museum].

Remarks.—While closely allied to *L. huachuca*, this species appears to be consistently different in both sexes and well deserving of a name. I take pleasure in naming this species for my good friend Dr. E. A. Chapin, of the National Museum, as a slight token of my appreciation of many kindnesses, both past and present.

PHYLLOPHAGA (LISTROCHELUS) FLAVIPENNIS (Horn)

FIGURES 2, f-g; 10, a-d

Listrochelus flavipennis HORN, Trans. Amer. Ent. Soc., vol. 12, p. 123, 1885.

Male.—Elongate-oval, strongly shining, elytra sparsely haired above. Head with front closely and coarsely rugose, transverse ridge of vertex moderately strong; clypeal suture hardly impressed, strongly bisinuate; clypeus punctured like front, apex truncate, apical margin slightly reflexed, angles strongly rounded. Antenna testaceous, 10-segmented, club about one-fourth to one-third longer than funicle. Thorax finely, moderately densely punctate, center of disk often with a suggestion of a smooth median line; base and apex strongly margined, sides finely crenulate and ciliate; front angles rounded, hind angles obtuse but subangulate. Elytra finely, rugosely punctate, with sparsely placed, short, erect hairs; first striae, besides sutural, strongly oblique, obsolescent in basal half, much wider and more pronounced apically. Pygidium strongly convex, highly polished, finely sparsely

punctate, with very short, suberect hairs. Abdomen widely, shallowly concave at middle, first five segments sparsely punctate, with short erect hairs; sixth segment a little shorter than the preceding, less densely but more coarsely punctured, with a faint longitudinal median sulcus. Claws of all the tarsi strongly pectinate along a double margin, without larger intercalated teeth. First segment of hind tarsus equal to second.

Female.—Antennal club a little shorter than the funicle. Pygidium convex but flattened, the entire disk very highly polished and smooth, with fine and sparse punctures, each of the latter bearing a short, suberect hair; apex rounded, with a row of coarse yellow bristles. All tarsal claws serrate along a double line (rarely apparently only along a single line) and each with a moderately large triangular tooth at about the middle. Abdomen highly polished, slightly convex, with fine punctures and short, sparse hairs, those of the subequal segments 5 and 6 somewhat longer. Otherwise similar to the male.

Length.—14–16.5 mm. *Width*.—6.5–7 mm.

Type.—In the Horn collection.

Type locality.—"Arizona."

Specimens examined: Males, 51; females, 9. ARIZONA: Pima, Pima, Gila, Graham, and Cochise Counties, in the southeastern parts of the State; July and August. NEW MEXICO: 'New Mexico' [U.S.N.M.]; Silver City, July 22 [Snow Museum].

Remarks.—This species and *L. granti* are quite conspicuous in the genus by their rufous thorax and shining, testaceous elytra. Apparently there is but little variation within the species. The females are rare in collections.

PHYLLOPHAGA (LISTROCHELUS) GRANTI, new species

FIGURES 4, *g*; 5, *d*; 10, *e-h*; 13, *j*

Male.—Elongate, subparallel, strongly shining; rufotestaceous, the head and thorax rufous. Head with front coarsely and variolately punctate, the punctures not contiguous and with several smaller punctures intermixed; transverse carina strongly indicated, surface behind it impunctate; base of clypeus faintly sinuate, hardly reflexed, the angles broadly rounded. Antenna 10-segmented, unicolorous, club one-fourth longer than the funicle. Thorax finely, not densely punctate on disk, the punctures closer at sides and apex, a slight median impunctate area visible; lateral margins with long cilia, coarsely crenate, angles well indicated but obtuse; base with strong marginal line. Elytra finely, subrugosely punctate, with fine, short, erect hairs; the striae on disk oblique and moderately prominent. Pygidium strongly convex, highly polished, moderately coarsely and not densely punctate, with short, suberect hairs; apex truncate and

ciliate. Abdomen flattened and faintly concave at center, highly polished except for a few patches of pruinosity at sides of segments 3-5; at center of segments 1-4 with fine, sparse granules and small hairs; segment 5 nearly plane at middle, with a few coarse punctures and hairs along the apical margin and at the sides; sixth segment shorter than the fifth, smooth at the center and coarsely, setigerously punctate at the sides; both fifth and sixth with a moderate longitudinal sulcus at the middle. All claws strongly pectinate along a double margin and without any larger teeth intercalated. Hind tarsus with first segment shorter than the second. Front tarsus without a small spine at inner apex of each segment.

Female.—Antenna shorter than funicle. Pygidium flattened and rugose in basal three-fifths, with fine, dense punctures and short suberect hair; apical two-fifths of disk slightly and gradually raised from the disk, polished and very sparsely punctate, apex densely ciliate; pygidial disk from a lateral view appearing quite flat, to slightly concave. Abdomen slightly convex, somewhat polished, coarsely punctate; fifth segment with a suggestion of two blunt transverse parallel ridges near base; sixth with very coarse, dense punctures, the hairs moderately long and erect. All claws with a submedian tooth and serrate along a double margin (at times apparently along a single margin only), except that the inner hind claw *usually* does not have the larger intercalated tooth. Otherwise as in the male.

Length.—14-17 mm. *Width*.—6-7.5 mm.

Types.—Holotype and allotype are from Patagonia, Ariz., collected on July 6 by M. A. Cazier (Saylor collection) and are in the United States National Museum (No. 53763).

Paratypes: Males, 13; females, 3. ARIZONA: Fort Grant [U.S. N.M. and Saylor]; Patagonia, July 6 (Cazier) (Ross and Cazier) [Saylor and Cazier]; Catalina Mountains, 5,500 feet [Saylor]; Nogales, Santa Cruz County (Nunenmacher) [Saylor]; Santa Rita Mountains [Saylor]; Tucson, July [Saylor]. MEXICO: Bakachaka, Rio Mayo, Sonora, August 25 (Gentry) [Saylor].

Remarks.—The female pygidium varies slightly as to the convexity of the disk, in one example being flat and semirugose and in the other semiconcave and rugose. Externally similar in general facies to *L. flavipennis* but quickly separated by the tumid clypeus of both sexes as well as the quite different male genitalia.

PHYLLOPHAGA (LISTROCHELUS) MUCOREA (LeConte)

FIGURES 8, d-f

- Listrochelus mucoreus* LECONTE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, p. 263, 1856.—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 144, 1878.—BATES, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 173, 1888. *Listrochelus tezanus* LECONTE, op. cit., p. 263, 1856.—HORN, op. cit., p. 144, 1878. *Listrochelus obtusus* LECONTE, op. cit., p. 264, 1856.—HORN, op. cit., p. 144, 1878.

Male.—Robust-oval, shining rufocastaneous, usually with pruinose patches on sides of thorax, basal part of pygidium and on the elytra to a greater or lesser extent (rarely elytra entirely pruinose and thorax nearly so); sparsely hairy on elytra, especially in basal part, rarely glabrous. Head with a very strong transverse carina, front very densely coarsely punctate; clypeus less densely and less coarsely punctured than front, middle of disk very sparsely so; apex subtruncately rounded, very strongly reflexed, angles strongly rounded. Antenna 10-segmented, club slightly longer than funicle. Thorax moderately densely, somewhat coarsely punctate, the punctures more sparse at center of disk and very dense near front margin; disk apparently glabrous; lateral margins crenulate, with long cilia; front angles subrounded, hind angles subangulate but very obtuse; front and hind margins strongly margined, the latter with long erect cilia. Elytra finely, somewhat rugosely punctate, with very fine sparse hairs, the latter often rather dense near base and scutellum; striae including sutural hardly obvious. Pygidium strongly convex, finely and densely punctured, with short suberect hair, the punctures much sparser in apical third. Abdomen highly polished at middle and flattened, very finely sparsely punctate, the sutures between the segments nearly punctate, with moderately long suberect hair. Hind tibia with longest spur spatulate at apex; first two tarsal segments subequal in length. All claws pectinate along a double margin; outer front claw with a large subapical tooth.

Female.—Antennal club equal to funicle. Pygidium densely pruinose and semiconvex in basal half, polished and flat in apical portion; the latter with a strong longitudinal impression at the middle; disk with fine, not dense, setigerous punctures, the hair short and suberect; apex subtruncate. Abdomen highly polished and convex at the middle, with fine and dense punctures, the hairs very short; fifth sternite gibbose slightly beyond the middle; sixth shorter than preceding and with dense, coarse, setigerous punctures. All claws, except hind inner one, serrate to subpectinate along a single margin (rarely with traces of a second margin), with a much larger tooth beyond the middle of each claw; the hind inner claw apparently serrate along a double margin and without a larger intercalated tooth. Hind spurs strongly spatulate. Otherwise similar to the male.

Length.—12.5–19 mm. *Width*.—5.5–9.5 mm.

Type.—In the LeConte collection.

Type locality.—"Fort Yuma, Colorado River, California" and "Eagle Pass, Texas" for *L. mucoreus*; "Texas" for *L. texanus*; and "Kansas, near Platt River" for *L. obtusus*.

Specimens examined.—Males, 91; females, 39. TEXAS: General along the southwestern boundary of the State and apparently com-

men in Zavala and Dimmit Counties in middle March; March 5 (Dimmit County) to June 22 (Del Rio). CALIFORNIA: Riverside, Imperial, and San Diego Counties only, February to April; apparently locally common at Indio early in April. NEW MEXICO: Mesilla Park [U.S.N.M.]. ARIZONA: Tucson and Yuma, in May [U.S.N.M.]. KANSAS: Syracuse (Schwarz) [Robinson]. MEXICO: "Mexico" [Casey]. Cited in literature (record questionable): "Cape San Lucas, Lower California" (Horn, 1878).

Remarks.—This species, with *L. pulcher* and *L. reinhardi*, forms a very definite complex and the females cannot well be separated, though the males are distinct in internal genitalic characters. Apparently a common species in much of the Southwest, coming frequently to light. The one Mexican example in the Casey collection agrees exactly with the United States females; this example is probably from the old Levette collection.

PHYLLOPHAGA (LISTROCHELUS) PULCHER (Linell)

FIGURES 8, g-i

Listrochelus pulcher LINELL, Proc. U. S. Nat. Mus., vol. 18, p. 730, 1896.

Male.—Elongate-oval, rufous to rufopiceous or rufocastaneous, with varying amounts of pruinosity on the thorax, elytra, pygidium, and abdomen, the elytra often entirely pruinose; at least the discal part of thorax and head always shining rufous; glabrous above except for elytra. Head with very strong transverse carina; front very densely and coarsely punctured, except for a narrow smooth area along the clypeal suture; clypeal suture biarcuate, fine, scarcely impressed; clypeus very long, less densely punctured than front and center of disk, often quite smooth, apex subtruncate and strongly reflexed, angles narrowly rounded. Antenna 10-segmented, club testaceous, subequal to, or very slightly longer than, funicle. Thorax finely, densely, irregularly punctured, most closely so at front margin and near sides; lateral margin ciliate, entire behind and slightly sinuate in front of the median dilation; hind angles distinct but obtuse, front angles less distinctly angulate; base and apex with strong marginal lines, basal margin ciliate. Elytra finely, densely, and regularly punctate, with fine suberect hairs, surface subrugosely wrinkled; striae including sutural rather feebly indicated. Pygidium strongly convex, finely densely punctate, with short, suberect hairs; basal three-fifths usually strongly pruinose and apical part usually strongly shining; apex ciliate, truncate. Abdomen very slightly, hardly noticeably concave in basal three segments, the fourth slightly convex, and fifth somewhat flattened; surface sparsely, finely, setigerously punctured; fifth segment rather smooth in basal half, punctured in apical half, and either

pruinose or highly polished; sixth shorter than fifth, slightly transversely flattened, finely densely punctate, with moderately long hairs. All tarsal claws finely pectinate along a double margin, the outer front claw only with a large subapical triangular tooth; the hind claws often pectinate-serrate rather than entirely pectinate (especially the inner and shorter row of pectinations). First segment of hind tarsi subequal to or slightly shorter than the second.

Female.—Antennal club subequal to funicle. Pygidium slightly convex and highly pruinose in basal half, strongly flattened and polished apically; disk with moderately fine and somewhat dense setigerous punctures, the hairs erect and short; apical half of disk usually less densely punctate and with a slight to moderate median longitudinal impression. Hind inner claw without a larger tooth, all other claws with a strong, triangular, intercalated tooth slightly beyond the middle, the surface from large tooth to base serrate to subpectinate, along a double margin. Otherwise as in the male.

Length.—15–18.5 mm. *Width*.—7.5–8.5 mm.

Type.—Male in United States National Museum; female in the Ulke collection.

Type locality.—"Skidmore, Texas."

Material examined.—Males, 9; females, 4. TEXAS: Corpus Christi, Oakville in April, Pleasanton in February, Bexar County and Stephenville on April 5.

Remarks.—Close to *L. mucorea* and allies but quite distinct, at least in the male sex. I have been unable to find characters either genitalic or otherwise that will hold in a series in separating the females but am confident that females of both species are present in the material at hand. Varies somewhat in the density of the elytral pruinosity, especially in the females.

PHYLLOPHAGA (LISTROCHELUS) REINHARDI, new species

FIGURES 8, a-c

Male.—Elongate-oval, rufocastaneous to piceocastaneous, sides of thorax and larger part of elytra usually pruinose, elytra with sparse minute hair, otherwise glabrous. Head and clypeus densely and coarsely punctate, transverse occipital ridge strong and entire; apex clypeus sharply reflexed, thickened, subtruncate, angles rounded. Antenna 10-segmented, segment 3 longer than 2, 4 and 5 subequal and each shorter than 3, 6 and 7 transverse; club one-fifth (or less) longer than funicle. Thorax densely, moderately coarsely punctate, with a smooth median longitudinal stripe; lateral margins finely to coarsely crenulate and ciliate; basal marginal line entire and ciliate; hind angles obtuse but obvious, front angles obtusely rounded.

Elytra finely, sparsely, and regularly punctate, with minute hair and some much longer hair near base of scutellum. Pygidium convex, pruinose at base, polished apically; densely, not coarsely punctate in basal half, much less densely so in apical half, apex truncate. Abdomen flattened at middle, pruinose at sides and somewhat at middle; segments finely, sparsely punctate at middle, fifth segment plane, sparsely punctate, with several short and erect hairs apically; sixth segment transversely impressed, with moderately dense marginal rows of short hairs at base and apex. All claws pectinate along a double margin, the outer row of pectinations of outer front tarsal claw with a large, acute subapical tooth. Hind tibia with one spur three-fourths as long as the other and the longest rather broadly spatulate.

Female.—Thorax a little more coarsely punctate. Antennal club subequal to funicle; club testaceous, funicle castaneous. Pygidium moderately convex, densely pruinose in basal half, highly shining in apical portion, the latter usually convex (in some few specimens there is a trace of a finely impressed longitudinal sulcus, but not nearly so distinct as in the females of *L. mucorea* and *L. pulcher*, in which the apical half of the disk is also flat); disk with moderately dense and coarse punctures, with short suberect hairs. Abdomen evenly convex, highly polished, and with fine, moderately dense punctures at the center. Hind tibial spurs spatulate. Inner hind claw without a larger intercalated tooth; all other claws serrate to subpectinate, with a strong intercalated tooth. Otherwise similar to male.

Length.—14–16 mm. *Width*.—6.5–8 mm.

Types.—Holotype and allotype are from Hidalgo County, Tex., collected by H. J. Reinhard on April 5, 1930, and are in the United States National Museum (No. 53764).

Paratypes: Males, 16; females, 8. TEXAS: Several, same data as types; Weslaco, March 16 (Clark) [Reinhard]; Alice, June 12; Mercedes, February (Urbahms) [Reinhard].

Remarks.—Externally rather similar in both sexes to *L. mucorea* but quite different in the male genital organs; the females are quickly differentiated by pygidial characters. Named for H. J. Reinhard, of the Agricultural and Mechanical College, Texas, who has contributed much valuable material, both for the present and for other studies of the author's.

PHYLLOPHAGA (LISTROCHELUS) PLENA (Fall)

FIGURES 8, *j-l*

Listrochelus plenus FALL, Journ. New York Ent. Soc., vol. 40, p. 199, 1932.

Male.—Elongate, rufocastaneous, head and thorax polished, elytra subshining, with some pruinosity, head and thorax apparently gla-

brous. Head with front coarsely and variolately punctate, though somewhat sparsely so at the center, transverse carina of vertex strongly marked; clypeus polished, sparsely punctured at sides and impunctate elsewhere; apex of clypeus strongly reflexed and subtruncate, angle broadly rounded. Antenna testaceous, club slightly longer than the funicle. Thoracic disk somewhat coarsely, moderately densely punctured, with a narrow impunctate median line; both base and apex strongly margined; sides of thorax subangularly dilated behind the middle, margin coarsely crenate in front of, and finely so or entire behind, the emargination; angles obtuse, not prominent. Elytra coarsely, rugosely wrinkled, striae except sutural only faintly indicated; disk moderately densely and finely punctate, with numerous small suberect hairs; sutural striae much narrower at base and apex. Pygidium strongly convex and highly polished, with very fine, sparse punctures; disk apparently glabrous, apex rounded. Abdomen highly polished, segments with moderately dense and fine punctures; sixth segment slightly shorter than the fifth, flattened, entire surface covered with moderately dense, somewhat coarse granules and fine, erect hairs. All claws pectinate along a double margin, the outer claws of front and middle tarsi each with a larger tooth just before the apex, hind claws pectinate to subserrate, without larger intercalated teeth.

Female.—Antennal club shorter than funicle. Thorax slightly more rufous and more densely punctate. Elytra highly pruinose. Pygidium polished, much smaller than in the male, convex, with a suggestion of a gibbosity each side of the middle, these two gibbosities nearer the lateral margins than to each other; pygidial surface very finely and sparsely punctate, with a few minute hairs apically. Abdomen strongly convex and very highly polished, segments 1-4 with sutures nearly obsolete and the surface with a few minute hairs; fifth large, declivous apically, hardly punctured; sixth subplanate, with sparse erect hairs. All claws apparently subpectinate or serrate along a single margin and each of the front and middle claws with a large tooth just before the apex, the hind tarsi without such larger teeth.

Length.—13-15 mm. *Width*.—6-6.5 mm.

Type.—In Fall collection.

Type locality.—"Baboquivari Mts. and Ajo, Arizona."

Specimens examined.—Males, 5; females, 10. ARIZONA: All specimens seen are from a rather limited locality—Pima and Cochise Counties; the majority of specimens came from the Santa Rita or Baboquivari Mountains, June and July.

Remarks.—The males are readily placed by the key, and the females may be rather easily determined by the characteristic pygidium, which is small and highly polished and convex only on the disk, as well as by the characteristic shape of the abdomen in lateral view.

PHYLLOPHAGA (LISTROCHELUS) OPACICOLLIS (Horn)

FIGURES 3, *k*; 11, *h-k**Listrochelus opacicollis* HORN, Trans. Amer. Ent. Soc., vol. 7, p. 145, 1878.

Male.—Small, robust-oval, strongly and entirely pruinose except for head, hairy above. Head with a weak but noticeable transverse carina, surface behind carina without punctures; front very strongly, densely, rugosely punctured, with moderately long and erect pile; clypeus punctured as front, the punctures, however, much finer, apex slightly reflexed, subtruncate at middle, with moderately rounded angles. Antenna 10-segmented, testaceous, club a little longer than funicle. Thorax finely, moderately densely punctured, less densely so at center, with longer, erect, yellowish hairs; lateral margins strongly dilated at middle, very finely crenulate, with very long yellowish cilia; front angles rounded, hind margins subangular but very obtuse. Elytra finely, rugosely punctate, with long erect hair, striae except sutural obsolete. Pygidium strongly convex, highly polished, very finely, moderately densely punctate, with short suberect hairs, apex subtruncate. Abdomen strongly, transversely gibbose at middle, surface finely, densely, and setigerously punctate, the hairs fine and long; sixth segment punctured as fifth, but surface flatter and with a median longitudinal carina faintly indicated. Hind tibia moderately densely pilose within. All tarsal claws each with a small hardly obvious submedian tooth, the surface between the tooth and base of claw very minutely crenulate. First two segments of front tarsus each with small inner spinelike projections at apex; hind tarsi moderately hairy, first segment slender, and but little wider at apex than at base.

Female.—Antennal club slightly shorter than funicle. Pygidium convex, sides straight and strongly convergent apically, the apex truncate. Disk with coarse and moderately dense punctures and with short suberect hairs, the surface rugose. Abdomen evenly convex, highly polished, and sparsely punctured; fifth sternite slightly depressed apically, with a few scattered coarse punctures among the finer ones; sixth segment with coarse scattered punctures, surface rugose. All claws with a short tooth at center, surface between tooth and claw base minutely serrate. First segment of front tarsi with a blunt spine at inner apex. Otherwise similar to male.

Length.—11–14 mm. *Width*.—5–6.5 mm.

Type.—In the Horn collection.

Type locality.—"Utah, Arizona and New Mexico."

Specimens examined.—Males, 22; females, 17. ARIZONA: General in the eastern half of the State, from Williams south, and east to Cochise County, July. UTAH: Cedar City, Iron County, June 25

(Knaus) [U.S.N.M.]. NEW MEXICO: Jemez Springs, Galiena Creek, 8,500 feet, July 24 [Saylor].

Remarks.—Can be readily confused only with *L. fimbripes*, *L. koehleriana*, and more especially *L. tarsalis*, but is the only one of this group having densely pruinose thorax covered with long hair, and may thus be separated readily in both sexes.

PHYLLOPHAGA (LISTROCHELUS) TARSALIS (Schaeffer)

FIGURES 2, *a*; 3, *m*; 4, *d*; 9, *g-j*

Listrochelus tarsalis SCHAEFFER, Ent. News, vol. 19, p. 319, 1908.

Male.—Small, elongate, very deeply pruinose above; hairy above except for the glabrous and impunctate thoracic disk. Head very coarsely, rugosely, and contiguously punctate, with moderately long erect hair; the punctures of clypeus a little less dense at sides of apex; transverse carina strongly indicated, impunctate behind; apex of clypeus slightly rounded, slightly reflexed, angles broadly rounded. Antenna unicolorous, 10-segmented, club over a fourth longer than the funicle. Prothoracic disk apparently without punctures except for a very few just inside the center of both the apical and basal margins; all margins ciliate; the lateral margins with very long hair and coarsely crenate in apical half, and finely serrate or straight in basal half; hind angles very broadly rounded, just barely indicated. Elytra finely punctate, with long, erect, and moderately dense hairs; striae except for the weak sutural costae not indicated. Pygidium moderately convex, polished, finely and densely punctate, with short suberect hairs; disk declivous before apex, the latter truncate and ciliate. Abdomen highly polished except for lateral pruinose patches; center of disk somewhat depressed and flattened, segments 3 and 4 somewhat transversely elevated at centers; fifth segment with faint longitudinal sulcus; sixth flattened, impunctate immediately at the center. Hind tibia with very long and extremely dense hairs on the apical two-thirds of the inner surface. Hind tarsus with first segment over half as wide at apex as long, and with a strong wing-shaped projection in apical two-thirds (see figures). Front tarsus with a strong, sharp, triangular spine at inner apex of first tarsal segment, the spine of the second segment hardly noticeable. All claws weakly serrate along a single margin; without larger intermixed teeth. Hind tarsal segments moderately densely pilose, the hairs long and fine.

Female.—Antennae rufocastaneous, the club testaceous and as long as segments 3–7 of the funicle combined. Pygidium flattened, faintly tumid near apex; surface finely, densely punctate, with short erect pile; basal half of disk pruinose, apex shining and subtruncate. Abdomen more convex than in the male and the transverse elevations

less noticeable; fifth segment coarsely and moderately densely punctate; sixth segment slightly convex, shorter than and more coarsely and sparsely punctate than the preceding segment. First segment of hind tarsus slightly expanded each side at apex (as in diagram). All claws finely serrate along a single margin and each with a very fine submedian tooth. All other characters, as well as the spined front tarsi, as in male.

Length.—12.5–14 mm. *Width*.—5.5–6.5 mm.

Type.—In the United States National Museum.

Type locality.—"Santa Rita Mts., Arizona."

Specimens examined.—Males, 15; females, 16. ARIZONA: Pinal, Pima, Cochise, and Graham Counties, in the southeastern parts of the State, June 6 (Comstock) to August 8 (Huachuca Mountains). NEW MEXICO: Silver City.

Remarks.—Though resembling several small and densely pruinose species, *L. tarsalis* is the only one with a thorax that is apparently (view vertically) impunctate and glabrous, except at the sides. Also, the first hind tarsal segment is always very strongly expanded near the inner apex in the male and somewhat more so than usual in the female; the type of tarsal expansion in both sexes is not quite duplicated in any of the others species in the genus.

PHYLLOPHAGA (LISTROCHELUS) SCUTICEPS (Bates)

FIGURE 6, *k-n*

Listrochelus scuticeps BATES, Biologia Centrali-Americana, vol. 2, pt. 2, p. 171, 1888.

Male.—Oblong-oval, rufotestaceous, head and thorax shining rufous, elytra partly to almost entirely pruinose. Head subrugose with dense, gross, and variolate punctures, apparently glabrous; transverse carina of vertex moderately well indicated, surface behind carina impunctate; clypeus punctured as front, disk flattened and glabrous, apex reflexed and truncate, angles moderately broadly rounded. Antenna 10-segmented, unicolorous rufotestaceous, club subequal to funicle. Thorax with disk densely, finely, rather regularly punctured, somewhat denser near sides and apex; base and apex strongly margined; lateral margins coarsely crenate, ciliate, angles obtusely rounded, the hind angles not subangulate. Elytra finely, moderately densely punctured, with minute recumbent hairs, surface subrugose, costae besides sutural weakly indicated. Pygidium strongly convex, moderately densely, finely punctured, with short suberect hairs; apex truncate, and margin slightly thickened and a little reflexed, ciliate. Abdomen flattened at middle, slightly polished, strongly pruinose at sides; sparsely, finely punctate at center, with short erect hairs, the punctures and hairs larger and coarser near sides; sixth segment

shorter than fifth, slightly subrugosely, sparsely punctate, with moderately long erect hairs. All claws moderately coarsely serrate along a single margin, without intercalated larger teeth on front tarsi; first segment of hind tarsi slightly shorter than second.

Female.—Antennal club shorter than funicle. Clypeus with small impunctate area at center base (usually). Pygidium convex, moderately densely and not coarsely punctate, with short suberect hair, punctures sparser in apical third, basal half of disk subopaque, remainder polished. Abdomen convex, highly polished, segments 2-4 inclusive slightly, transversely gibbose. All tarsal claws serrate along a single margin, with a fine triangular tooth at the middle (hind claws worn in the single female at hand and appear to lack the central tooth, although Bates in his original description of the species says all claws have the central tooth). Otherwise as in the male.

Length.—11.5-13.5 mm. (to 17 mm. in var. *major* of Bates).
Width.—5.5-6.5 mm.

Type.—In the British Museum (Natural History).

Type locality.—"Villa Lerdo in Durango, also Tapachula in Chiapas, Mexico."

Specimens examined.—Males, 16; females, 17. TEXAS: Presidio, August [Saylor], June 28 [Reinhard], and July 18 [Saylor]. MEXICO: Torreon, Chiapas, June 17 (Al Meade) [Saylor]; Coahuila [Robinson]; San Antonio, Durango, 5,000 feet, June 10, 1937 (Meade) [Saylor]. Villa Juarez, 300 feet, May 20, 1937 [Saylor]; J. Manuel, El Salto, Durango, June 5, 1937 [Saylor].

Remarks.—Specimens from Texas and Mexico were compared with the types in the British Museum and found to agree well. Rare in the United States and not heretofore recorded from this country, but may be quickly placed by the male genitalia, which in form have no close relatives in our fauna, and by the strongly convex thorax of the female.

PHYLLOPHAGA (LISTROCHELUS) FIMBRIPES (LeConte)

FIGURES 3, l; 9, k-n

Listrochelus fimbripes LECONTE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, p. 264, 1856.—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 147, 1878.

Male.—Oblong-ovate, rufotestaceous to somewhat piceotestaceous at times, elytra usually slightly to completely pruinose, otherwise shining above, pilose. Head with front very coarsely, densely, and rugosely punctured, frequently with a suggestion of a longitudinal carina, with sparse, short, erect hair; vertex with strong transverse carina, area posterior to carina impunctate; clypeus densely strongly punctured but usually not so densely so as front; apex clypeus very

faintly widely emarginate, or subtruncate, slightly reflexed, lateral angles moderately strongly rounded. Antenna 10-segmented, club darker in color than funicle and varying from slightly longer to nearly one-quarter longer than the funicle. Thorax with most of the disk very finely, rather sparsely punctured, the punctures much larger just behind the front margin and along the basal margin; center of disk with small impunctate longitudinal area; along central basal discal area and along all the margins, also frequently near the side discal areas, with long, fine, and erect testaceous hairs, these sometimes rather thinned out through wear; lateral margins finely and completely crenulate, front and hind angles strongly obtuse but subangulate; basal margin entire though weak at center base. Elytra very finely densely punctured, subrugosely wrinkled, with short erect hairs near basal and scutellar area; sutural striae strong, the two others moderately well indicated and strongly oblique. Pygidium somewhat convex, very finely, moderately densely punctate, with very small subprocumbent hairs (often nearly all abraded), discal area frequently very finely transversely wrinkled; apex truncate, ciliate, margin thickened. Abdomen polished at middle, pruinose at sides, with sparse punctures bearing short erect hairs: abdomen in lateral view exactly as in *L. falsa* (see fig. 2, c); fifth with single row of fine erect hairs near apex, apex somewhat narrowly incised at middle and the segment with a longitudinal sulcus along the entire center area; sixth as long as or longer than fifth, flat polished, slightly and sparsely punctured with a few short suberect hairs, and with a faint longitudinal median sulcus. Claws usually without any trace of a tooth, and the basal margin very fine, scarcely noticeably serrate, at times, however (not at all uncommonly), with a noticeable, short, triangular tooth above middle, and almost subbasal in position. Front tarsi with first segment rather strongly prolonged into a tooth at inner apex, the second much less noticeably so. Front tibiae strongly tridentate. First segment of hind tarsi subequal to second in length but somewhat wider at apex. Hind tibiae with many to few long thin hairs on inner side, often rather noticeably pilose.

Female.—Antennal club slightly longer than segments 3-7 combined. Pygidium a little less convex and sides more convergent apically than in the opposite sex. Abdomen evenly convex, highly polished, and finely and sparsely punctate at middle; fifth and sixth segments in apical halves and at sides coarsely punctate. First segment of the front tarsus with a small triangular tooth at the inner apex. All claws with a small triangular tooth at the middle, the surface between the tooth and the claw base minutely crenulate. Otherwise similar to the male.

Length.—11.5-14.5 mm. *Width*.—5-6.5 mm.

Type.—In the LeConte collection.

Type locality.—"Fort Riley, Kansas."

Specimens examined.—Males, 31; females, 6. ARIZONA: Flagstaff, July (Wickham) [U.S.N.M.]. NEW MEXICO: Tenaja (Wickham) [U.S.N.M.]; Torrence County (Douglas) [U.S.N.M.]; Grady, July 16 (Beamer) [Snow Museum]. NEBRASKA: Lincoln, July [U.S.N.M.]. COLORADO: "Colorado" and Colorado Springs [U.S.N.M.]; La Junta, July 21 (Rehn and Hebard) [American Museum]; Cragmore, June [U.S.N.M.]. TEXAS: New Braunfels [Robinson].

Remarks.—This species forms, along with *L. koehleriana* and *L. neomexicana*, a rather compact group of the genus, in the characters of the hairy hind tibiae and tarsi, rugosely sculptured head, and robust facies. The male genitalia are closely allied as regards similarity in form but are distinct and are apparently not variable within the species; the main specific differences are evidenced in the aedeagus rather than in the lateral lobes of the claspers.

PHYLLOPHAGA (LISTROCHELUS) FALSA (LeConte)

FIGURES 2, c; 4, f; 9, a-c

Listrochelus falsus LECONTE, Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, p. 264, 1856.—HORN, Trans. Amer. Ent. Soc., vol. 7, p. 147, 1878.

Listrochelus langeri CHAPIN, Proc. Biol. Soc. Washington, vol. 47, p. 93, 1934 (new synonymy).

Male.—Oblong-oval, wider behind, rufous above, sparsely pilose, thorax shining; elytra very highly pruinose. Head with front flattened, moderately coarsely punctate, vertex with a moderately prominent transverse carina; clypeus punctured as front, with sparse erect hairs, apex subtruncate and faintly emarginate, slightly reflexed, angles moderately broadly rounded. Antenna 10-segmented, unicolorous, club one-sixth longer than funicle. Thorax shining, finely, moderately densely, irregularly punctured, with short scattered hairs near base and sides; front angles broadly rounded, hind angles obtuse but moderately distinct, base and apex strongly margined; lateral margins ciliate and finely crenulate, less obviously so behind the moderate median dilation. Elytra finely punctured, rugosely wrinkled, with scattered small yellowish hairs arising from the highly pruinose surface; striae, except sutural, not obvious. Pygidium strongly convex, highly polished, very finely, moderately densely punctured, each puncture bearing a minute recumbent hair; apex broad and subtruncate. Abdomen convex, with segments 1 to 3 polished and moderately densely pilose; third segment abruptly raised at middle apex; fourth and fifth segments of approximately equal size and each very sparsely pilose, the two together having a common transverse sulcus, the latter being deepest at the point of

juncture of the two segments; sixth segment flattened, as long as or slightly longer than the fifth, sparsely finely punctured, and with a definite though shallow median longitudinal groove. Front tarsus with first segment slightly though perceptibly prolonged into a slight spine on inner side of apex; claws usually very finely, hardly evidently crenulate and without a tooth (a very fine suggestion of a tooth rarely noticeable). Middle claws as in front. Hind claws also minutely crenulate but usually with a very faint submedian tooth among the serrations, at least on the inner claw. First segment of hind tarsus shorter than the second, and very strongly prolonged inwardly at apex into a blunt tooth or lobe, the first segment being somewhat triangular in shape (see fig. 4, f).

Female.—Antennal club shorter than funicle. Pygidium evenly convex, entire disk polished and with regularly arranged, fine, dense punctures, the hairs short and suberect; apex thickened and ciliate. Abdomen evenly convex, highly polished at middle and with very fine and dense setigerous punctures, the hairs fine and minute; fifth and sixth sternites of approximately equal size, the sixth and apical portions of the preceding segment more coarsely punctate than the remainder of the abdomen. All claws with a short triangular tooth at the middle, surface between the tooth and claw base minutely serrate. First segment of the front tarsus with a blunt, short spine at inner apex. Otherwise similar to male.

Length.—12–15.5 mm. *Width*.—6–7 mm.

Type.—In the LeConte collection.

Type locality.—"Platt River, Kansas."

Specimens examined.—Males, 66; females, 39. CALIFORNIA: Barstow, July 18 [Saylor]. ARIZONA: General in the southeastern part of the State. Recorded several times as taken on ponderosa pine (*Pinus ponderosa*), July and August. COLORADO: General in the State; seen from Larkspur to Pagosa Springs and from the country in between; June to August; recorded on ponderosa pine. NEW MEXICO: General; seen from Rio Arriba County and southeast to Roswell; June to September.

Remarks.—In habitus and type of male genitalia the present species is most closely related to *L. fimbripes* and allies but is abundantly distinct in the hardly pilose hind tarsi and tibiae, the male genitalia, etc. Has been taken on several occasions in the adult state feeding on yellow pine. An interesting note concerning the life history is the following, excerpted from the field notes of A. J. Jaenicke, at the time stationed at the Fort Valley Experiment Station at Flagstaff, Ariz.: "Larvae of these beetles are doing extensive damage to the western yellow pine seedlings at Flagstaff, by cutting off the roots."

PHYLLOPHAGA (LISTROCHELUS) FALSA NOGALES, new subspecies

Male.—Entire elytra and thorax very densely pruinose above, the latter glabrous on disk, the punctures very fine and almost obscured by the pruinosity. Clypeus apparently glabrous on disk. First segment of hind tarsi slender and hardly at all expanded apically (no more than is normal in any species of the genus); first two segments subequal in length. All other characters, including the genitalia, the same as in the typical form.

Female.—Thorax very densely pruinose, punctures almost obscured by the pruinosity. Clypeal disk apparently glabrous. Otherwise the same as in the typical form.

Length.—13–15 mm. *Width*.—6.5–7.5 mm.

Types.—Holotype and allotype are from Mount Washington, 6,000 feet, Nogales, Ariz. (Saylor), and are deposited in the United States National Museum (No. 53765).

Paratypes: Males, 1; females, 1. ARIZONA: Huachuca Mountains [Saylor].

Remarks.—The densely pruinose and hardly perceptibly punctate thorax, the nonexpanded first hind tarsal segment of the male, and the nonpilose clypeus of the present subspecies seem to justify setting it off as distinct; indeed, the entire facies of the beetle are closer to those of *L. tarsalis* than to *L. falsa*, owing to the highly pruinose condition of the dorsal area. Were it not for the apparently identical genitalia of the males, I would not hesitate to describe this as a separate species.

PHYLLOPHAGA (LISTROCHELUS) KOEHLERIANA, new species

FIGURES 3, n; 11, a–d

Male.—Robust, elongate, hairy above; head and thorax rufous and shining, the elytra darker and strongly pruinose. Head very coarsely and rugosely punctate, with erect hair; transverse carina well marked, usually impunctate behind; clypeus strongly transverse, a little more finely and densely punctate than the front; clypeal apex strongly reflexed, subtruncate, angles moderately rounded. Antenna rufo-testaceous; club testaceous and slightly longer than the funicle. Thoracic disk with very fine and fine punctures intermixed, the puncturation rather dense at sides and front, the larger punctures more noticeable along the front margin; a slight central area of the disk impunctate; center-base, near sides and along the front margins with long or short hairs; lateral margins ciliate, finely crenulate, the angles prominent but obtuse. Elytra finely subrugosely punctate, with long and erect moderately dense hairs; striae, except sutural, obsolete. Pygidium convex, highly polished, very finely and densely punctate,

with fine procumbent hairs; apex widely truncate and ciliate. Abdomen polished, subpruinose at sides; surface finely and densely punctate with short and erect hair; segments 4 and 5 together forming between them a deep transverse sulcus, surface of each punctured nearly as in the preceding segments; sixth polished, faintly longitudinally sulcate at center, impunctate at middle, with a few coarse punctures at sides. Hind tibia with very dense and long hair on the apical three-fourths of the inner surface; first segment of the hind tarsi gradually widened toward the apex, the latter nearly half as wide as the length of the segment. First segment of front tarsus with a very long, sharp spine at inner apex, the width of the segment at the apex about three-fifths of its total length, second segment without inner, apical spine. All claws finely crenulate or serrate along a single margin, usually without larger intermixed teeth, at most with a very faint suggestion of a larger median tooth and that usually on the hind claws, if present at all. Hind tarsal segments each with a moderately dense patch of long hairs arranged in a row on each side of the under surface and pointing outward.

Female.—Antennal club slightly shorter than the funicle. Abdomen evenly convex, highly polished and very finely, sparsely punctate at center; apical half of the fifth segment flattened transversely; sixth segment one-fourth shorter than the preceding and with coarse sparse punctures. Hind tibia with hairs only moderately dense and not at all fine and ciliate; hind tarsi sparsely hairy. All claws with a strong tooth above the middle, the surface between tooth and claw base very minutely serrate or crenulate. First segment of front tarsus with a strong inner spine, this smaller than in the male.

Length.—12–15.5 mm. *Width*.—6–7 mm.

Types.—Holotype and allotype are from Koehler, N. Mex., and are in the National Museum (No. 53766).

Paratypes: Males, 38; females, 39. NEW MEXICO: Koehler [U.S. N.M. and Saylor]; prairie near Koehler (Wickham) [U.S.N.M. and Saylor]; Hot Springs, 7,000 feet [U.S.N.M. and Saylor]; Las Vegas (Linell) [U.S.N.M.]. TEXAS: "S. Texas" [Robinson].

Remarks.—In the large series at hand there is very little external variation and apparently none in the male genitalia, which closely resembles those of *L. fimbripes* but are constantly different in the shape of the aedeagus. The key characters should readily separate the two species.

The following notes, taken at the time of capture of part of the specimens (by V. L. Wildermuth, at Koehler, N. Mex., July 3, 1914), should be of much interest: "Tonight there occurred a remarkable flight of this beetle. The air was full of them, and the roar, for it was more a roar than a buzzing, from them was wonderful. They

were like several swarms of bees all in the air over one's head at once. Many came to the light of the tent, but the great majority of them seemed to be flying quite high. The flight lasted from about 8 until 9:30. The day previous had been rainy and heavy rains had fallen the past four days. July 13: This flight has continued to a greater or less extent each night since the first record—last night there were millions of the beetles in the air, and at times one could hardly remain out of doors because of them hitting the person in the face. Tent roofs and sides were fairly covered with them, and a large handful at a time could be picked up. I am told that many are found in the ground of the gardens hereabouts, and in fact I saw a great many turned up in a garden at the packing house. There are no trees closer than 3 miles from camp, and these are limited to scrub oak and several species of pine. The range around is covered with grama grass and weeds. Two classes of the latter predominate, namely *Gutierrezia* sp. (brown-weed) and *Artemesia frigida* (worm-wood, or sage brush). Many native lupines abound. The soil is mostly a sandy clay loam. An unusual amount of moisture has fallen this season and it has been well distributed. To date it has rained 29 out of 59 days since we arrived in camp."

PHYLLOPHAGA (LISTROCHELUS) NEOMEXICANA, new species

FIGURES 2, j; 4, h; 11, e-g

Male.—Apparently not different externally from *L. koehleriana*. The male genitalia are distinct in the two species; the characters of the genitalia do not vary in the rather extensive series of *L. koehleriana* at hand.

Female.—Unknown.

Length.—13–15 mm. *Width*.—6–6.5 mm.

Types.—Two males, both from Roswell, N. Mex., collected by Brant on July 2. The holotype is in the United States National Museum (No. 53767), and the paratype is in the Saylor collection.

Remarks.—Though only the two specimens are at hand, the aedeagus is so different from that of *L. koehleriana* that I have no hesitation in describing *L. neomexicana*; reference to the genitalic figures will allow of ready separation of the two forms.

PHYLLOPHAGA (LISTROCHELUS) PARILIS (Bates)

FIGURE 11, o-r

Listrochelus parilis BATES, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 172, 1888.

Male.—Oblong-ovate, highly polished, head and thorax rufous, otherwise rufocastaneous, elytra pruinose or opaque, above with

scattered hairs. Head with coarse and dense punctures, with a few fine ones intermixed; clypeus with rounded, usually moderately reflected apex, angles very broadly rounded. Antennal club one-sixth longer than the funicle. Thorax with fine, dense punctures, disk usually glabrous; lateral margins coarsely crenate and with long cilia. Elytra finely, regularly punctate, with scattered fine and erect hairs, the latter moderately long; striae, except sutural, obsolete. Pygidium convex, strongly and entirely polished, with fine scattered punctures, apparently glabrous; apex truncate and slightly sinuate. Abdomen with segment 3 transversely raised and segments 4 and 5 having in common between them a deep and wide transverse impression; fifth and sixth more coarsely punctate and each with a very weak longitudinal sulcus at the middle. All claws serrate apparently along a single margin (traces of a double margin under power of $20\times$) and each with a very small tooth slightly above the middle; this, however, is frequently worn down on one or all claws so that it is not visible at all. Inner face of hind tibia with moderately long bristles (not hairs); under soles of hind tarsus with but very sparse bristles (not hair). Inner apex of first front tarsal segment with a very blunt and short spine.

Female.—Antennal club equal to segments 3–7 combined. Pygidium as in male but much more flattened. Abdomen convex, apex of fifth segment somewhat depressed, smooth; sixth segment convex, the disk sparsely and setigerously punctured. All claws minutely dentate near the base and with a small but sharp median tooth.

Length.—12–14 mm. *Width*.—5.5–7 mm.

Type.—In the British Museum (Natural History).

Type locality.—"Refugio and Cuidad in Durango, Mexico."

Specimens examined.—Males, 11; females, 2. TEXAS: Davis Mountains [Saylor]; Davis Mountains, July 9, 1921, (C-D. Duncan) [Van Dyke]. MEXICO: Cusihiuriachic, Chihuahua, [Saylor]; Zacatecas, Zac. [Saylor].

Remarks.—The males at hand fit Bates's description exactly, and this, coupled with the fact that both the Mexican localities recorded by Bates for *L. parilis* are close to those from which come my Mexican examples (which are specifically identical with my Texas specimens), leaves little doubt that the species is correctly determined.

This species is most closely related to *L. fimbripes* and *L. koehleriana*, from both of which it can be readily separated by the spinose and not hairy hind tibiae and tarsi; also, the male genitalia are specifically different among the three species.

PHYLLOPHAGA (LISTROCHELUS) CAVATA (Bates)

FIGURE 12, *d-f*

Listrochelus cavatus BATES, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 170, 1888.

Male.—Robust-oval, rufotestaceous to rufocastaneous above, strongly shining, glabrous above. Head lacking the transverse carina of vertex; front sparsely, moderately coarsely punctate; clypeal suture fine, not impressed; clypeus transverse and somewhat bowl-shaped owing to the moderately reflexed apical margin, surface finely and densely punctured; apex truncate, angles narrowly rounded. Antenna 10-segmented, testaceous, segment 3 the longest of the funicle, club a little shorter than the funicle. Thorax subrugosely, finely, and densely punctate; base and apex with strong marginal lines and both without cilia; sides roundly, arcuately dilated, the entire margin coarsely crenate and ciliate; hind angles very obtusely subangulate, nearly rounded, the front angles similar. Elytra finely, densely, and regularly punctate; sutural and first and second striae prominent. Pygidium unusually convex, highly polished, finely, sparsely, and irregularly punctured, apparently glabrous (minute hairs visible under high power); apex thickened and truncate; apical half of the propygidium very finely and very sparsely punctate. Abdomen highly polished, smooth (and hardly perceptibly punctate) at center; apical half of the fifth and the entire sixth segments with a fine longitudinal impression at center of each; sixth segment shorter than fifth, finely and sparsely punctate. Tarsal claws pectinate along a single margin, without larger intercalated teeth; first segment of hind tarsi noticeably shorter than the second. First segment of front tarsus with a very small inner spine at apex. Hind tibial spurs long, slender. Front tibia with upper tooth weakly indicated and closely adjacent to the large median tooth.

Female (from Bates's description).—Pygidium plane, polished, very sparsely punctate; apical margin explanate and bidentate. Apex of fifth abdominal segment transversely sulcate, sixth large, convex, grossly punctate, apex with deep fovea and margin widely and profoundly sinuate. All claws with a subapical tooth.

Length.—11–13 mm. *Width*.—6–7 mm.

Type.—In the British Museum (Natural History).

Type locality.—"San Antonio de Arriba and Mexico City, in Mexico." Also "Cuidad and Ventanas in Durango, and Real del Monte in Hidalgo for the variety *durangoensis*."

Specimens examined.—Males, 2; females, 0. MEXICO: 1 cotype from Cuidad in Durango, lent by the British Museum. NEW MEXICO: Las Vegas, August 11 [Saylor].

Remarks.—This typical form of the species is rare in the United States, and only the one specimen from this country is known to the author at the present time; various closely related species are found along our southern boundaries and in northern Mexico (*L. cochisea* Saylor and *L. meadei* Saylor).

PHYLLOPHAGA (LISTROCHELUS) MICROS (Bates)

FIGURE 12, *g-i*

Listrochelus micros BATES, Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, p. 170, 1888.

Male.—Robust-oval, rufotestaceous to rufocastaneous, strongly shining, glabrous dorsally except at lateral margins of the thorax and elytra. Head with front sparsely, coarsely, and somewhat regularly punctate; clypeal apex moderately to strongly reflexed, surface, densely punctate. Antennal club longer throughout than in *L. cavata* but subequal to the funicle. Thorax with a small median smooth space. First segment of hind tarsus nearly equal to second. Upper tooth of front tibiae strong, the three teeth equidistant. Elytra rather rugosely wrinkled, much more so than in *L. cavata*. Hind tarsi nearly as long as their respective tibiae. Unless otherwise indicated, the thoracic, elytral, pygidial, abdominal, and claw characters are as described for *L. cavata*.

Female.—Antennal club shorter than funicle. Pygidium convex, highly polished and smooth, very finely and sparsely punctate, apparently glabrous (minute hairs visible only under high power), apex with two obtuse lobes of moderate length, the two separated by a U-shaped notch (see drawing). Abdomen convex and highly polished, segments 1-5 connate; sixth segment long, apex with a moderately wide emargination, the surface just before the emargination with a small fovea; surface moderately densely and coarsely punctate, apex ciliate. Front tibiae strongly tridentate. All claws with a strong median tooth, surface between the tooth and the base dentate along a single margin. Hind tarsus shorter than their respective tibiae. Otherwise similar to the male.

Length.—8-14 mm. *Width.*—6-7.5 mm.

Type.—In the British Museum (Natural History).

Type locality.—Toluca, Mexico.

Specimens examined.—Males, 7; females, 3. COLORADO: Denver, July 1902 [Saylor]. MEXICO: Pachuca, Hidalgo [Saylor]; Guerrero Mills, Hidalgo [Saylor and Sanderson]; San Miguel, Hidalgo [Saylor and Sanderson]; Toluca (cotype) [Saylor].

Remarks.—The Colorado specimen is much lighter in color than the Mexican examples and a trifle more elongate; also the antennal club is much more robust in the former specimen and just a little

shorter than the funicle, but the majority of characters ally it with this species and the genitalia are apparently identical. There is some little variation in the Mexican specimens, and the extremes in size and color look quite different superficially, but all essential characters are apparently exactly similar, and in several instances the extremes have been collected together.

PHYLLOPHAGA (LISTROCHELUS) MEADEI, new species

FIGURES 4, c; 12, j-l

Male.—Antennal club testaceous and slightly longer than the rufous funicle. Clypeal apex weakly reflexed. Thorax with a small irregular median smooth area. Fifth abdominal segment at apex weakly incised, not longitudinally impressed; sixth with faint trace of the impressed longitudinal line. First two hind tarsal segments subequal in length. All three teeth of front tibia strongly developed and equidistant. Otherwise, all characters are the same as described for *L. cavata*.

Female.—Antennal club much shorter than the funicle. Pygidium plane on disk, widely and transversely gibbose just before the rather acuminate apex (especially evident in lateral view); disk very sparsely punctate; apical margin itself slightly incised and the sides expanded a bit so as to form two very blunt teeth, which are separated from each other by a moderately broad and rather shallow emargination. Apical segment of abdomen convex and coarsely punctate and having only the faintest trace of a very small fovea at the middle apex (absent entirely in a few specimens). All claws serrate along a single margin with a large triangular tooth nearly at the center.

Length.—12–14 mm. *Width*.—6–7 mm.

Types.—Holotype and allotype are from San Antonio in Durango, Mexico, and were collected by Al Meade on June 10, 1937 [Saylor], and are deposited in the National Museum (No. 53768).

Paratypes: Males, 11; females, 19. MEXICO: From the same locality as the types [Saylor]; Torreon, Chiapas, June 14, 1937 (Meade) [Saylor]; J. Manuel, El Salto, Durango, 9,300 feet, June 10, 1937 (Meade) [Saylor].

Remarks.—Described in the present revision since it is so closely allied with the rest of the *L. cavata* complex and may be expected to occur within our borders.

PHYLLOPHAGA (LISTROCHELUS) COCHISA, new species

FIGURE 12, a-c

Male.—Rufotestaceous to rufocastaneous above, strongly shining. Front moderately, not densely punctate. Antennal club subequal to funicle. Thorax finely, densely, somewhat irregularly punctate, with

suggestions of a smooth median discal area. Upper tooth of front tibia moderately strong. Hind tarsus longer than the tibia. Otherwise similar in all respects to *L. cavata*.

Female.—Antennal club robust, much shorter than the funicle. Pygidium highly polished, glabrous, finely and moderately densely punctate, surface minutely alutaceous; disk strongly gibbose before apex, the apex nearly truncate and somewhat thickened. Abdomen highly polished, segments 1–5 subconnate; sixth segment large, apical half with a moderately broad U-shaped emargination. Hind tarsus as long as their tibiae. All claws with a moderately large tooth slightly beyond the middle, the surface between the tooth and claw base denticulate. Otherwise as in the male.

Length.—11–13 mm. *Width*.—5.5–6.7 mm.

Types.—Holotype and allotype are from Cochise County, Ariz., July [Saylor] and are deposited in the United States National Museum (No. 53769).

Paratypes.—Males, 1; females, 3. ARIZONA: Cochise County [Saylor]; Pinery Canyon, Cochise County, Chiricahua Mountains, 6,000 feet, July 19, 1919 (Witmer Stone) [American Museum]. MEXICO: "Mexico" [Casey].

Remarks.—Apparently rather local in our territory. The Mexican examples in the Casey collection agree in all respects except that the female pygidium is more closely punctate on the apical gibbosity than in the typical form.

PHYLLOPHAGA (LISTROCHELUS) TEXENSIS, new species

FIGURE 10, m, o

Male.—Robust-oval, thorax rufous and polished, remainder of dorsal surface rufocastaneous; elytra and sides of thorax usually densely pruinose, apparently glabrous above. Antenna castaneous, club testaceous and subequal to the funicle. Head with dense variolate punctures, those at the middle of the clypeal disk a little finer than those of the front; clypeal suture strongly biarcuate; clypeal apex reflexed, subtruncate, the angles broadly rounded; vertex with a moderately strong transverse carina, the surface behind this impunctate. Thorax with fine, dense, regularly placed punctures, these closer near apex and somewhat sparser at the center of the disk; lateral margins coarsely crenate, with rather short cilia; hind angles obtuse. Elytra with coarse, sparse punctures, with minute hairs visible in a strong light; striae obsolete, except the sutural, which widens noticeably posteriorly. Pygidium evenly convex, with dense, fine punctures and short, minute hair; basal three-fifths pruinose, apical portion polished and less densely punctate. Abdomen flat and pruinose at center, with fine, sparse, setigerous punctures; sixth seg-

ment convex, impunctate in basal half and coarsely punctate in apical half, with a distinct though very blunt transverse carina at the center. Inner front claw always with a distinct tooth at center, all others (rarely the inner claws of both kind and middle tarsi have faint traces of a larger tooth) serrate apparently along a single margin, and without larger intercalated teeth.

Female.—Antennal club equal to funicle. Punctuation of head much coarser and denser than in the male. Pygidium flattened, with sparse, fine punctures and very short, suberect hair, the punctures in the apical polished half of the disk very sparse; basal discal area pruinose or subpruinose. Abdomen polished, evenly convex, with sparse and fine setigerous punctures; sixth segment and apical half of the preceding sternite more coarsely punctate than the remaining segments. All claws with a strong median tooth, surface basad of the tooth serrate (hind claws in one female worn and the larger teeth barely visible). Otherwise as in male.

Length.—11–14 mm. *Width*.—5.5–6.8 mm.

Types.—From Brownsville, Tex., June 5, 1932 [Saylor], deposited in the United States National Museum (No. 53770).

Paratypes: Males, 13; females, 4. TEXAS: Esperanza Ranch, Brownsville, July (Schwarz) [U.S.N.M.]; Del Rio, July 23, 955 feet (Wickham) [U.S.N.M.]; Sabinal, June 8 (Pratt) [U.S.N.M.]; Brownsville, July (Linsley) [Saylor and Snow Museum]; Sanderson, July 1937 (Al Meade) [Saylor]; Stillwater, July 4, light trap [Reinhard]; San Juan, May 10 (Stugard) [Sanderson]; Uvalde, June 15 and May (Linsley) [Saylor].

Remarks.—Externally probably closest superficially to *L. cushmani*, but quite different in the male genital and claw characters. The male genitalia of the present species are not closely similar in form to any others in the genus.

PHYLLOPHAGA (LISTROCHELUS) WICKHAMI, new species

FIGURES 2, h, i; 10 i, j

Male.—Robust-oval to elongate-oval, testaceous to rufotestaceous, thorax and head rufous, strongly shining; elytra subpruinose to shining. Head with front coarsely, moderately densely, variolately punctate, apparently glabrous; vertex with transverse carina strongly elevated, surface behind this impunctate; clypeus punctured as front but a little less densely so and usually with small impunctate area at center of disk, apex subtruncate, angles greatly rounded, giving the clypeus almost a semicircular appearance, apex moderately reflexed; clypeal suture strongly biarcuate. Antenna 10-segmented, rufotestaceous, club testaceous, one-fifth to one-fourth longer than funicle to almost one-third longer, segments 6 and 7 of funicle transverse and prolonged

on inner side into small spines. Thorax highly polished, with fine sparse punctures separated by a distance equal to two to four times their diameters, denser at sides and apex, usually disk entirely glabrous, rarely with few hairs near margins; lateral margins moderately strongly crenulate, with long cilia; base and apex of thorax strongly, entirely margined; angles subangulate and very obtuse. Elytra moderately densely, finely punctured, and rugosely wrinkled, with short sparse suberect hair; costae, except sutural, not indicated. Pygidium convex, shining, very sparsely and finely punctured, punctures sparsest near apex, with short suberect hairs, apex subtruncate. Abdomen flattened at center, with very shallow, rather wide, median longitudinal sulcus; surface finely sparsely punctate, with short and erect hairs; fifth plane; sixth usually slightly longer than fifth, flattened, punctured as fifth, apex ciliate. All claws finely serrate to subpectinate along a double margin, usually the serrations of similar size, rarely with the outer row of outer front claw with a much larger, submedian, acute tooth. First and second hind tarsal segments subequal in length and of nearly the same shape and width throughout.

Female.—Antennal club equal to funicle. Clypeal disk with or without an impunctate area at the base; apex less reflexed than in the male and more widely rounded. Pygidium convex but flattened on disk, highly and entirely polished, with sparse, very fine punctures, each bearing a minute subprocumbent hair; apex rounded, slightly declivous, ciliate. Front and middle claws serrate along a single margin and each with a small median tooth intercalated with the serrations; the inner of the hind claws without a larger intercalated tooth and the larger tooth of the outer claw very minute or absent (in the two examples at hand). Abdomen convex, highly polished, nearly glabrous and impunctate at center; fifth segment finely and sparsely punctate, with fine suberect hairs; sixth segment more coarsely punctate than the fifth. Otherwise as in the male.

Length.—12–14 mm. *Width*.—5.5–7 mm.

Types.—"Deming, New Mexico, August 1918 (Wickham)" (male) and "Castolon, Tex., June 11, 1928 (F. Bibby)" [Reinhard] (female), both in the United States National Museum (No. 53771).

Paratypes: Males, 12; females, 2. NEW MEXICO: Deming, July 11, 4,300 feet (Wickham) [U. S. N. M.]; Pyramid Peak, Dona Ana County, July 30 (Fosberg) [Los Angeles Museum and Saylor]; "N. M., August" [Van Dyke]. TEXAS: Brewster County, Chisos Mountains, July 10 (Mitchell and Cushman) [U. S. N. M.]; Castolon, June 11 (F. Bibby) [Reinhard]; Marathon, June 18 (Linsley) [Saylor]; Presidio County, July 16 (Beamer) [Snow Museum]. ARIZONA: Wilcox, July 24 (Hubbard and Schwarz) [U. S. N. M.]; "Arizona" (Al Meade) [Saylor].

Remarks.—Superficially resembles *L. cochisa* or a small *flavipennis* but not at all close to either species. Named for H. F. Wickham, who collected such fine series of many species in this group.

PHYLLOPHAGA (LISTROCHELUS) CUSHMANI, new species

FIGURE 6, i, j

Male.—Elongate-oval, strongly shining, elytra opaque or pruinose; apparently glabrous except for elytra. Head with dense and very coarse punctures, those of the clypeal apex sparser than those of front and somewhat finer; clypeal apex truncate and slightly reflexed, angles broadly rounded, transverse carina of vertex strongly indicated, impunctate behind. Antennal club short but subequal to funicle. Thorax with moderately coarse and dense punctures; lateral margins coarsely crenate, with short and coarse cilia; disk under high magnification showing extremely minute hairs. Elytra punctured as thorax, but more sparsely so, the hairs much more obvious; striae not obvious, the sutural striae also not prominent. Pygidium convex, with very fine and not dense punctures, with short, fine hairs, apex truncate. Abdomen flattened, highly polished, with very fine and sparse punctures; fifth sternite slightly impressed transversely at apex; sixth segment convex, with a slight transverse carina just before the middle, the surface posterior to this impunctate, that anterior to it coarsely punctured, with short and erect hair. All claws with a strong median tooth, surface between tooth and claw base minutely serrate. First segment of hind tarsus normal; first segment of front tarsus without a spine at the inner apex.

Female.—Unknown.

Length.—12.5–14 mm. *Width.*—5–6 mm.

Types.—Brewster County, Chisos Mountains, Tex., June 10, 1908, a male collected at light by Cushman and Mitchell; in the United States National Museum (No. 53772).

Paratypes: Males, 8; females, 0. TEXAS: Brewster County, Chisos Mountains, June 10 [U.S.N.M.]; Presidio, May 1 (Owen, Jr.) [Reinhard]; Big Bend Park, Brewster County, July 29, 1937 (Rollin Baker) [Cartwright]. NEW MEXICO: Pyramid Peak, Dona Ana County, August 9 (Fosberg) [Los Angeles Museum]. ARIZONA: "Arizona," August 9, 1937 (Al Meade) [Saylor]. MEXICO: Sierra Mojada, Coahuila [Saylor]; Villa Juarez, Tamps, 300 feet, May 26, 1937 (Meade) [Saylor]; J. Manuel, El Salto, Durango, June 3, 1937, 9,300 feet (Meade) [Saylor]; Torreon, Chiapas, May 28, 1937 [Saylor].

Remarks.—Superficially close to *L. texensis* but very distinct in the male genitalia as well as in the presence of the median larger tooth of the tarsal claw. Named for one of the collectors, R. A. Cushman, of the U. S. Bureau of Entomology and Plant Quarantine.

PHYLLOPHAGA (LISTROCHELUS) MACMURRYI, new species

FIGURES 3, *j*; 10, *k*, *l*, *n*

Male.—Robust-oval, testaceorufous, head and thorax rufous, shining and densely hairy above. Head and clypeus coarsely, variolately, not rugosely punctate, the punctures of front and vertex separated by one-half to once their diameters, with erect hair; the punctures of clypeus a little smaller and sparser than those of the front; carina of vertex moderately sharp and distinct; clypeus sharply reflexed, apex subtruncate, angles rounded. Antenna 9-segmented, third and fourth segments longer than broad and subequal, fifth and sixth transverse or subtransverse and shorter than the third and fourth; club small and somewhat lighter colored than funicle and subequal to, or slightly longer than, the funicle. Thorax with lateral margins roundly dilated, with long cilia, hardly noticeably crenulate; hind angles varying from with no trace of any angle to slightly through very obtusely angulate, the basal margin fine but entire; front angles obtuse and not prominent; disk finely punctured, the punctures separated by a distance equal to once to twice their diameters, with fine long erect hair over the major portion of the disk. Elytra moderately rugosely wrinkled, finely sparsely punctate, with very fine, long, erect hairs, these hairs shorter near apex; apex of each elytron as viewed from above apparently truncate or subtruncate; pygidium convex, highly polished, very finely, scarcely perceptibly punctate, with sparse, suberect, short hairs in basal area, apex rounded to subtruncate and often somewhat explanate. Abdomen polished at center, smooth, with dense short hair on sides, sutures obsolete; fifth segment wrinkled on sides, apical margin somewhat raised and slightly, semicircularly emarginate at apex; sixth segment longer than fifth, with a raised, transverse, cariniform process in the shape of a very wide V just apical from the basal margin; the summit of the carinae with a few short hairs, the remainder of the surface flattened and impunctate except for the ciliate apical margin. All claws finely pectinate along a double margin, the outer margin of each claw with a large tooth just slightly beyond middle, at times the hind claws subpectinate or serrate.

Female.—Thorax slightly less densely punctate. Antenna apparently 9-segmented, club ovate but nearly equal to funicle. Pygidium somewhat convexly flattened, disk with fine, moderately dense punctures, with a few very fine, short, and erect hairs; disk in apical two-fifths moderately deeply and broadly longitudinally impressed, the surface each side of the impression slightly gibbose; apex slightly emarginate, the sides of emargination broadly rounded. Abdomen convex, highly polished and with fine, moderately dense setiferous punctures, the hairs rather fine and short; segments 1–4 with sutures nearly effaced at the middle; fifth segment transversely impressed in

apical third and rather coarsely punctured thereon, with much finer punctures basally; sixth as long as preceding, somewhat convex, with dense and coarse punctures, and moderately long and erect hairs. Hind tarsus distinctly shorter than their tibiae. All claws serrate along a double margin (20 \times) and with a somewhat larger tooth at the middle. Otherwise as in the male.

Length.—10–13 mm. *Width*.—5–6 mm.

Types.—Holotype male from Wichita Mountains Wildlife Refuge, Oklahoma, April 1938 (Frank McMurry) [Saylor] and allotype female from Austin, Tex., July [Saylor]; both are in the United States National Museum (No. 53773).

Paratypes: Males, 16; females, 2. OKLAHOMA: Headquarters site, Wichita Mountains Wildlife Refuge, May 11, 1938 (Frank McMurry) [Saylor and U. S. Biological Survey]; Wichita Mountains, April 16, 1918 (R. Kuntz) [Univ. Oklahoma]; Wichita National Forest, May 3, 1936 [Saylor]. TEXAS: Austin, June and July [Saylor].

Remarks.—This hairy little species is abundantly distinct from all other United States species of the group, and the small robust body and shining surface, with the dense long hair of the entire dorsal surface readily distinguish it. Named for Frank McMurry, of the U. S. Biological Survey, who collected the Oklahoma specimens and transmitted them to the writer.

PHYLLOPHAGA (LISTROCHELUS) DUNCANI (Barrett)

FIGURE 6, *g, h*

Listrochelus duncani BARRETT, Can. Ent., vol. 65, p. 129, 1933.

Male.—Oblong-oval, shining above, sparsely pilose, rufotestaceous, head and thorax rufous. Head with front and clypeus coarsely, very rugosely punctate, punctures of front variolate and nearly contiguous, those of clypeus smaller and much denser at the center of disk, front and clypeus with sparse, short, erect hair; transverse occipital ridge moderately sharp and distinct, entire; clypeus moderately reflexed and very slightly emarginate at apex, angles broadly rounded. Antenna 10-segmented, 3–5 subequal, 6 and 7 transverse, club lighter in color and nearly one-third longer than funicle. Thorax very finely, rather regularly punctured, with a broad, median, impunctate strip, disk apparently glabrous except for several minute hairs at center of base; front and hind marginal lines entire, that of front margin greatly widened; lateral margins coarsely crenate, ciliate, hind and front angles obtuse but evident, not prominent. Elytra finely wrinkled, very finely sparsely punctate, with minute semierect hair; sutural striae wide and prominent, elytral disk with one strongly oblique stria running from inside the humeral umbos toward the sutural stria and fading out just before reaching the latter. Pygidium convex,

faintly pruinose at base, finely, moderately densely punctate, with minute hair, apex polished and subtruncate. Abdomen subpruinose at sides, slightly shining at middle, very slightly convex and finely sparsely punctate at center, with short suberect hair; fifth segment plane, very slightly, hardly noticeably, transversely impressed near apex; sixth with faint longitudinal sulcus, surface moderately densely, coarsely punctate, with sparse short hairs. All claws with a small triangular, median tooth, and minutely serrate on a single margin.

Female.—Unknown.

Length.—12 m. *Width*.—5.5 mm.

Type: In the collection of the Snow Museum at Kansas University.

Type locality.—"Chiricahua Mts., Ariz., VII-2-32, Duncan Collector."

Specimens examined.—The holotype, examined through the kindness of the describer, R. E. Barrett, of Saticoy, Calif.

Remarks.—The male genitalia are not closely similar in form to those of any other species. Known only from the type.

PHYLLOPHAGA (LISTROCHELUS) ARIZONA, new species

FIGURE 6, e, f

Male.—Identical in all respects with *L. duncani*, differing only in the conformation of the genitalia (see fig. 6, e, f).

Female.—More robust, elytra with longer and more obvious hair; antennal club small and shorter than the funicle. All claws with a strong median tooth and minutely serrate between the base and the tooth along a single margin. Transverse carina of vertex well developed. Pygidium slightly convex, smooth, polished, slightly pruinose basally; disk with fine and sparse punctures, apex rounded. Abdomen convex, polished, smooth, apex of fifth and of sixth segment with coarse and moderately dense punctures. Otherwise as in the male.

Length.—11–15 mm. *Width*.—5.5–6 mm.

Types.—Holotype male from Prescott, Ariz. [Saylor], and allotype female from Fort Wingate, N. Mex. [Casey], both deposited in the United States National Museum (No. 53774).

Paratypes: Males, 7; females, 3. ARIZONA: Prescott, May [Saylor]; Williams, July 1920 (Barber and Schwarz) [U.S.N.M.]; Bright Angel (Barber and Schwarz) [U.S.N.M.]; Phoenix [Saylor], Springerville, 1927 (Beamer) [Snow Museum]. TEXAS: Fedor, May [Saylor].

Remarks.—Some variation occurs: The transverse carina of the vertex is sometimes interrupted at the middle; the smooth central area of the thorax may not be a distinct band but may have an uneven edge; the pygidium may be less densely and more coarsely punctate; and the antennal club may vary from one-fourth to one-third longer than the funicle.

PHYLLOPHAGA (LISTROCHELUS) TIMIDA (Horn)

FIGURE 3, a-c

Listrochelus timidus HORN, Trans. Amer. Ent. Soc., vol. 7, p. 146, 1878.

Male.—Small, apparently glabrous above; color rufous to rufotestaceous, the elytra sometimes nearly testaceous. Front of head entirely covered with gross, contiguous, variolate punctures; transverse ridge of vertex not prominent, the surface immediately behind the ridge densely punctured, the punctures much smaller and more transverse than those of the front, and with dense, minute, subprocumbent hair; clypeus punctured nearly as coarsely as front but much less densely so, the punctures not contiguous; clypeal apex narrowly, not deeply emarginate, angles broadly rounded and moderately reflexed; eyes rather large. Antenna 10-segmented, club subovate and nearly equal to funicle in length. Thorax with coarse, moderately dense punctures, the latter much closer along the apical margin and most sparse at the center of the disk; lateral margins entire, nonciliate, the angles obtusely angulate, front angles often slightly explanate; base and apex with strong, complete marginal lines. Elytra coarsely, not densely punctate, the oblique striae moderately prominent; many of the punctures, especially near and at the apex, with minute, hardly evident hairs. Pygidium subopaque, slightly convex, sparsely and coarsely punctured, with short procumbent hairs, apex subrounded. Abdomen flattened at middle, sparsely and finely punctate, shining; fifth segment one-half as long as fourth and plane except for a row of coarse setigerous punctures along the apical margin. All claws finely serrate to nearly plane and smooth, without any larger intercalated teeth. Front tarsus without projections at the inner apex of each segment.

Female.—Antennal club equal to segments 3-7 combined, abdomen slightly convex, polished, fifth segment and apex of the sixth coarsely but sparsely punctate; all claws with a strong tooth slightly beyond the middle, the surface between the tooth and the claw base minutely serrate. Otherwise similar to the male.

Length.—8-11 mm. *Width*.—3.5-5 mm.

Type.—In the Horn collection in Philadelphia.

Type locality.—"Arizona."

Specimens examined.—Males, 116; females, 47. ARIZONA: Santa Catalina Mountains, Gila Bend, Tucson, Canyon Lake, Liberty, and base of Pinal Mountains, taken from April to late in September.

Remarks.—A common little species and one of the few in the genus in which the area of the vertex behind the transverse ridge of the front is densely, coarsely, and almost completely punctured; in most species this area is either entirely smooth or but sparsely punctate, and then only at the sides. The tarsal claws in fresh specimens are

distinctly though finely serrate, but they appear to be almost smooth in some worn specimens. The Mexican *L. mimicana* Saylor is with difficulty separated from this species externally, but the genitalia of the males are not only of radically different form but are nearly four times as large in the Mexican species as in ours. Also, *L. snowi* Saylor, described herein from Arizona, is rather close to *L. timida* but has different genitalia. The present species is commonly attracted to light.

PHYLLOPHAGA (LISTROCHELUS) SNOWI. new species

FIGURE 3, d-f

Male.—Small, shining, elongate; thorax rufous, otherwise testaceous to rufotestaceous; apparently glabrous above except for minute, scarcely perceptible elytral hairs. Head very coarsely, densely, and contiguously punctate; transverse ridge of vertex moderately strong, surface behind coarsely and entirely punctate; clypeal apex slightly emarginate, somewhat reflexed, angles very broadly rounded. Antennal club ovate, testaceous, and subequal to funicle. Thorax evenly convex, with coarse and dense punctures, and a row of impressed punctures just posterior to the apical margin; lateral margins entire, nonciliate, the angles broadly rounded and not explanate. Elytral striae, except sutural, obsolete. Pygidium convex, shining, with coarse and moderately dense punctures. Abdomen flattened, polished, the sixth segment impunctate at base, with coarse setigerous punctures along the apical margin. All claws with slight but distinct pectinations along a single margin, without intercalated teeth.

Female.—Unknown.

Length.—10 mm. *Width*.—5.5 mm.

Type.—The unique male type is from Congress, Ariz., collected by F. H. Snow in July, and is deposited in the collection of the Kansas Museum, from whence it was lent for study through Messrs. Sanderson and Benedict.

Remarks.—While superficially close to *L. timida*, the present species is easily distinguished through the characters of the male genitalia and the much more obvious claw pectination, the latter being at most minutely serrate in *L. timida*. It is interesting to speculate on the possibility that *L. snowi* has evolved from the *L. timida* type, since the apical portions of the male genitalia of the former appear to be merely an outfolding and flattening of the *L. timida* type; since the genitalia of each species are quite rigid, there is but little or no chance that the *L. snowi* genitalia are merely a deformed specimen of *L. timida*, and moreover, the two species are separated by external characters also.

PHYLLOPHAGA (LISTROCHELUS) SENEX (Horn)

FIGURE, 2, b

Listrochelus senex HORN, Trans. Amer. Ent. Soc., vol. 7, p. 148, 1878.

Male.—Oblong-oval, rufous and shining above, glabrous dorsally. Head without an obvious transverse carina on vertex, front very densely, coarsely, and variolately punctate; clypeal suture nearly straight; clypeus flat, more sparsely punctate than front; clypeal apex hardly at all reflexed, subtruncate, the center faintly emarginate, angles narrowly rounded. Antenna with club very robust (thickest in subgenus) and slightly longer than to one-third longer than, the funicle; segments 4-7 inclusive somewhat, to distinctly, transverse. Thorax very convex, with sparse coarse punctures in center disk, the punctures closer laterally; lateral margins coarsely crenate, front angles blunt, hind angles sharp but obtuse, base with a strong marginal line. Elytra sparsely and not very coarsely punctate, striae obsolete. Pygidium somewhat convex, smooth and shining, with very small punctures and very short and sparse hair, apex rounded. Abdomen polished, smooth, very sparsely and finely punctate; sixth segment nearly as long as the fifth and with a short backward-projecting lobe at center in lateral view (fig. 2, b), the apex of the lobe truncate, surface of the segment polished, smooth, sparsely and finely punctate. All claws long and slender, minutely serrate along a single margin, without any larger intercalated teeth.

Female.—Black or rufous in color; transverse ridge of occiput rather prominent; antennal club shorter than funicle; sixth abdominal segment plane, sparsely and coarsely punctate; pygidium slightly more coarsely punctate than in the male; all claws finely serrate along a single margin and each with a triangular tooth at center. Otherwise as in the male.

Length.—11-12.5 mm. *Width*.—5-6 mm.

Type.—In the Horn collection.

Type locality.—"Llano Estacado, Texas."

Specimens examined.—Males, 14; females, 3. TEXAS: Fort Clark [Saylor]. NEW MEXICO: Mesilla Park [U.S.N.M. and Saylor]; Albuquerque, May 22 (Schaeffer) [Robinson, U.S.N.M., Casey].

Remarks.—The color varies from rufous to or nearly quite black. Apparently rather rare in collections.

BIBLIOGRAPHY

1850. BLANCHARD, ÉMILE: Catalogue de la collection entomologique du Museum d'Histoire Naturelle de Paris, Coleoptera, 240 pp. Paris.
Describes the genus *Listrochelus* (pp. 141-142), with the Mexican *L. laportaei* Blanchard as the type species.
1856. LACORDAIRE, JEAN THEODORE: Histoire naturelle des insectes. Genera des coléoptères . . . , vol. 3, 594 pp. Paris.
Discusses (pp. 287-288) the generic characters and compares them with those of *Phyllophaga*.
1856. LECONTE, JOHN LAWRENCE: Synopsis of the Melolonthidae of the United States. Journ. Acad. Nat. Sci. Philadelphia, ser. 2, vol. 3, pp. 225-288.
Modifies the generic limits of *Listrochelus* (p. 262) and describes as new the species *L. mucoreus*, *texanus*, *obtusus*, *falsus*, *fimbripes*, and *scoparius*. (*L. texanus* and *obtusus* now = *mucoreus*.)
1863. ———: New species of North American Coleoptera. Smithsonian Misc. Coll., vol. 6, No. 167, 177 pp.
Describes as new *L. puberulus* (p. 78) and *L. densicollis* (p. 77).
1878. HORN, GEORGE H.: Revision of the species of *Listrochelus* of the United States. Trans. Amer. Ent. Soc., vol. 7, pp. 137-148.
Gives keys to all 7 known United States species and describes as new *L. senex*, *timidus*, *opacicollis*, *sociatus*, and *disparilis*. (*L. sociatus* has been removed to *Phyllophaga* by the present author.)
1885. ———: Descriptions of new North American Scarabaeidae. Trans. Amer. Ent. Soc., vol. 12, pp. 117-128.
Describes as new *L. flavipennis* and *gracilis* (p. 123).
1888. BATES, HENRY WALTER: Biologia Centrali-Americana, Coleoptera, vol. 2, pt. 2, 432 pp., 24 pls.
Lists (p. 169) the one Mexican species known and describes 8 new species from that country; lists also (p. 173) the United States species *L. mucoreus* and *scoparius* as having been seen from Mexico.
1894. HORN, GEORGE H.: The Coleoptera of Baja California. Proc. California Acad. Sci., ser. 2, vol. 4, pp. 302-449, 2 pls.
Describes as new *L. carminator* (p. 308).
1896. LINELL, MARTIN L.: New species of North American Coleoptera of the family Scarabaeidae. Proc. U. S. Nat. Mus., vol. 18, pp. 721-731.
Describes as new *L. pulcher* (p. 730).
1908. SCHAEFFER, CHARLES: New Coleoptera, with notes on some New Jersey Histeridae. Ent. News, vol. 19, pp. 318-321.
Describes as new *L. tarsalis* (p. 319).
1914. WICKHAM, HENRY FREDERICK: New Miocene Coleoptera from Florissant. Bull. Mus. Comp. Zool., vol. 58, pp. 421-494, 16 pls.
Describes (p. 459; pl. 6, fig. 10) the fossil species *L. puerilis* from the Miocene deposits at Florissant, Colo. (It is not at all certain that this species belongs in this genus, since the claws on the specimen cannot be seen in detail.)
1922. FALL, HENRY CLINTON: New Coleoptera, X. Can. Ent., vol. 54, pp. 170-173.
Describes as new *L. longiclavus* (p. 173). (This is a synonym of *Phyllophaga crinita* Burmeister.)

1932. FALL, HENRY CLINTON: New North American Scarabaeidae, with remarks on known species. Journ. New York Ent. Soc., vol. 40, pp. 183-204.
Describes as new *L. plenus* (p. 199) and *L. juvenilis* (p. 200). (*L. juvenilis* is now included in the subgenus *Phyllophaga* sensu stricto.)
1933. BARRETT, R. E.: New species of North American Scarabaeidae (Coleop.). Can. Ent., vol. 65, pp. 129-130.
Describes as new *L. duncant* (p. 129; pl. 8).
1934. CHAPIN, EDWARD ALBERT: A new *Listrochelus* injuring *Pinus ponderosa* Lawson in the Rocky Mountain region (Coleoptera: Scarabaeidae). Proc. Biol. Soc. Washington, vol. 47, pp. 93-94.
Describes as new *L. langeri* (a synonym of *L. falsus*).
1935. ———: Review of the genus *Chlaenobia* Blanchard (Coleoptera: Scarabaeidae). Smithsonian Misc. Coll., vol. 94, No. 9, 20 pp., 12 figs.
Revises the genus *Chlaenobia* (herein designated as a subgenus) and discusses generic concepts in the rhizotrogine scarabs.
1937. SAYLOR, LAWRENCE W.: Necessary changes in status of important rhizotrogid genera (Col. Scarabaeidae). Rev. Ent., vol. 7, pp. 318-322.
Discusses validity of genera in the *Phyllophaga* complex.
1938. ARROW, G. J.: The coleopterous genus *Anthypna*. Ann. Mag. Nat. Hist., ser. 11, vol. 2, pp. 285-290.
Mentions (p. 286) generic and subgeneric usage of names.
1939. SAYLOR, LAWRENCE W.: Revision of the beetles of the melolonthine subgenus *Phytalus* of the United States. Proc. U. S. Nat. Mus., vol. 86, pp. 157-167.
Revises the United States species of *Phytalus* and discusses further subgeneric revisions in the *Phyllophaga* complex of genera.

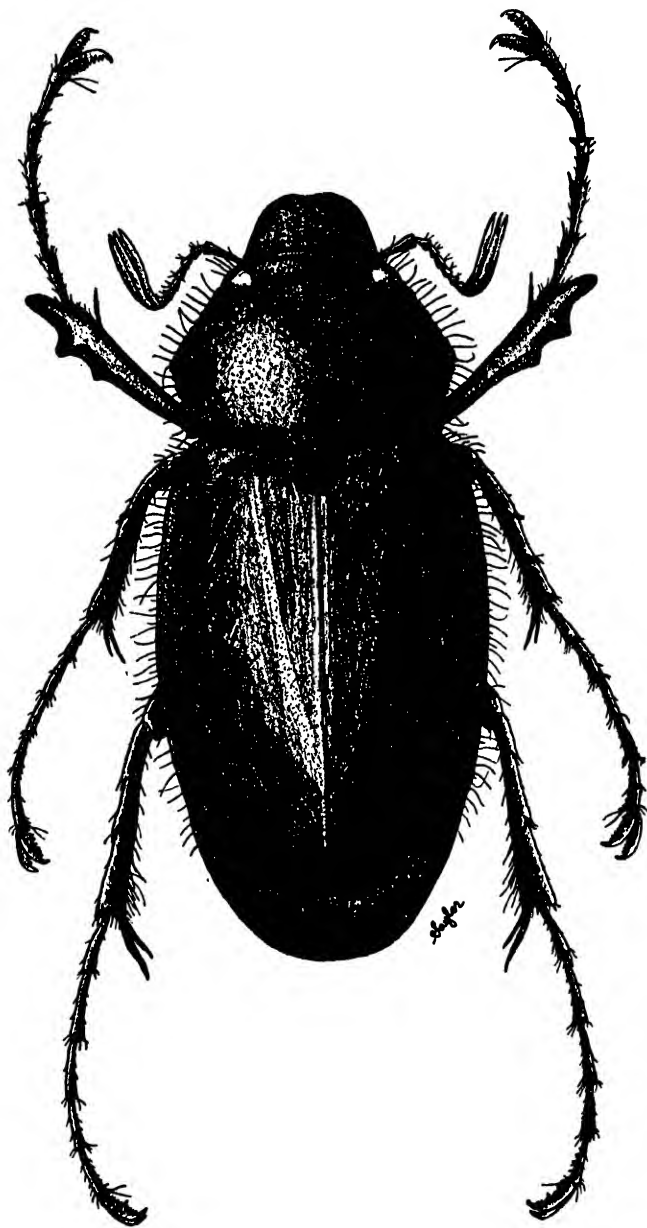


FIGURE 1.—Male specimen of *Phyllophaga* (*Listrochelus*) *disparilis* (Horn).

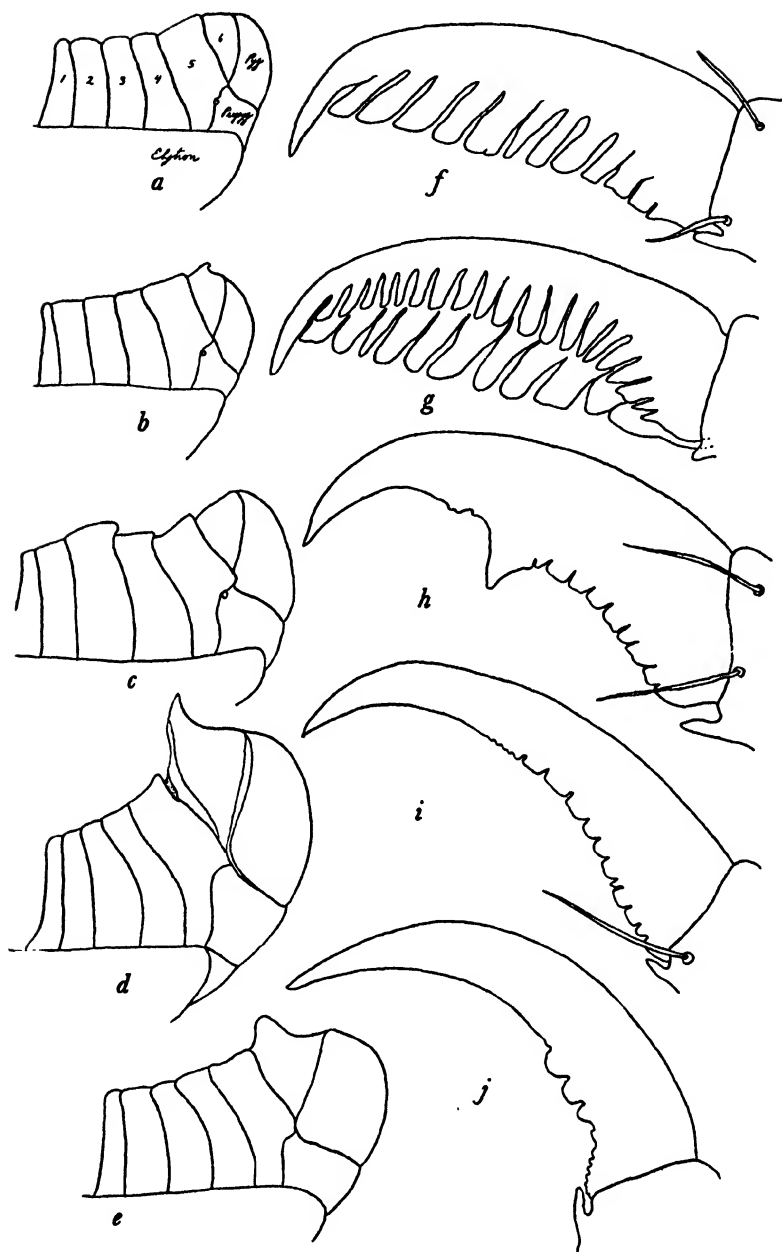


FIGURE 2.—Lateral views of male abdomen of (a) *Phyllophaga* (*Listrochelus*) *tarsalis*; (b) *P. (L.) senex*; (c) *P. (L.) falsa*; (d) *P. (L.) scoparia*; (e) *P. (L.) trochanter*. f-g, *P. (L.) flavipennis*: f, Outer side of front outer claw of male; g, inner side of front inner claw of male. h, i, *P. (L.) wickhami*: h, Outer side of front outer claw of male; i, outer side of hind outer claw of male. j, *P. (L.) neomexicana*: Outer side of hind outer claw of male.

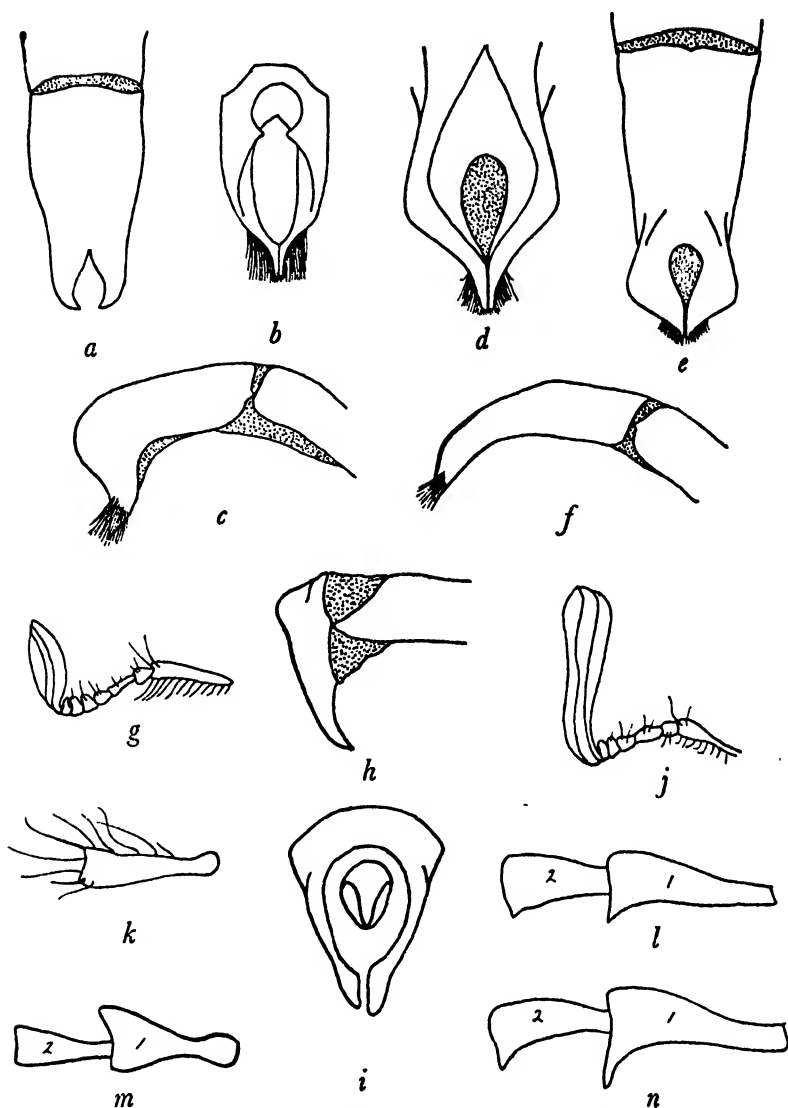


FIGURE 3.—*a-c*, *Phyllophaga (Listrochelus) timida*: *a*, Dorsal view of male genitalia; *b*, en-face view of male genitalia; *c*, lateral view of male genitalia. *d-f*, *P. (L.) snowi*: *d*, En-face view of male genitalia; *e*, en face-dorsal view of male genitalia; *f*, lateral view of male genitalia. *g*, *P. (L.) scoparia*: View of female antenna. *h, i*, *P. (L.) peninsularis*: *h*, Lateral view of male genitalia; *i*, en-face view of male genitalia. *j*, *P. (L.) macmurryi*: Male antenna. *k*, *P. (L.) opacicollis*: First hind tarsus of male. *l*, *P. (L.) fimbripes*: First two anterior tarsal segments of female. *m*, *P. (L.) tarsalis*: First tarsal segment of female. *n*, *P. (L.) koehleriana*: Front tarsal segments of female.

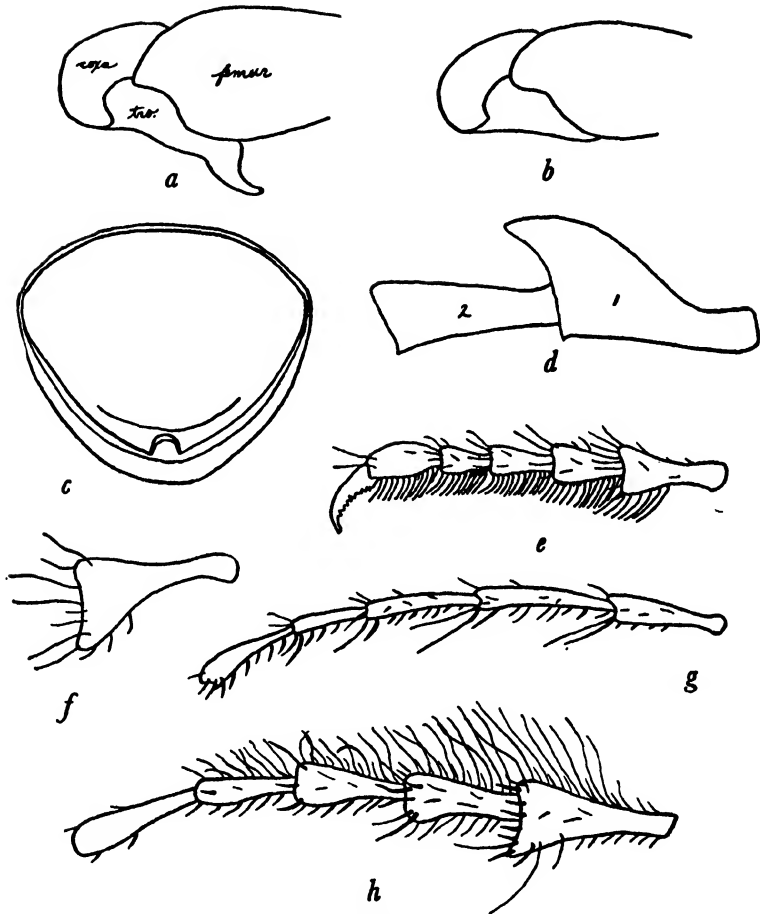


FIGURE 4.—*a*, *Phyllophaga* (*Listrochelus*) *trochanter*: Enlarged view of hind coxa and femur to show prolonged trochanter. *b*, Same of *P. (L.) scoparia*. *c*, *P. (L.) meadei*: Female pygidium. *d*, *P. (L.) tarsalis*: First two hind tarsal segments of male. *e*, *P. (L.) scoparia*: Hind tarsus of male. *f*, *P. (L.) falsa*: First hind tarsal segment of male. *g*, *P. (L.) granti*: Hind tarsus of male. *h*, *P. (L.) neomexicana*: Dorsal view of hind tarsus of male.

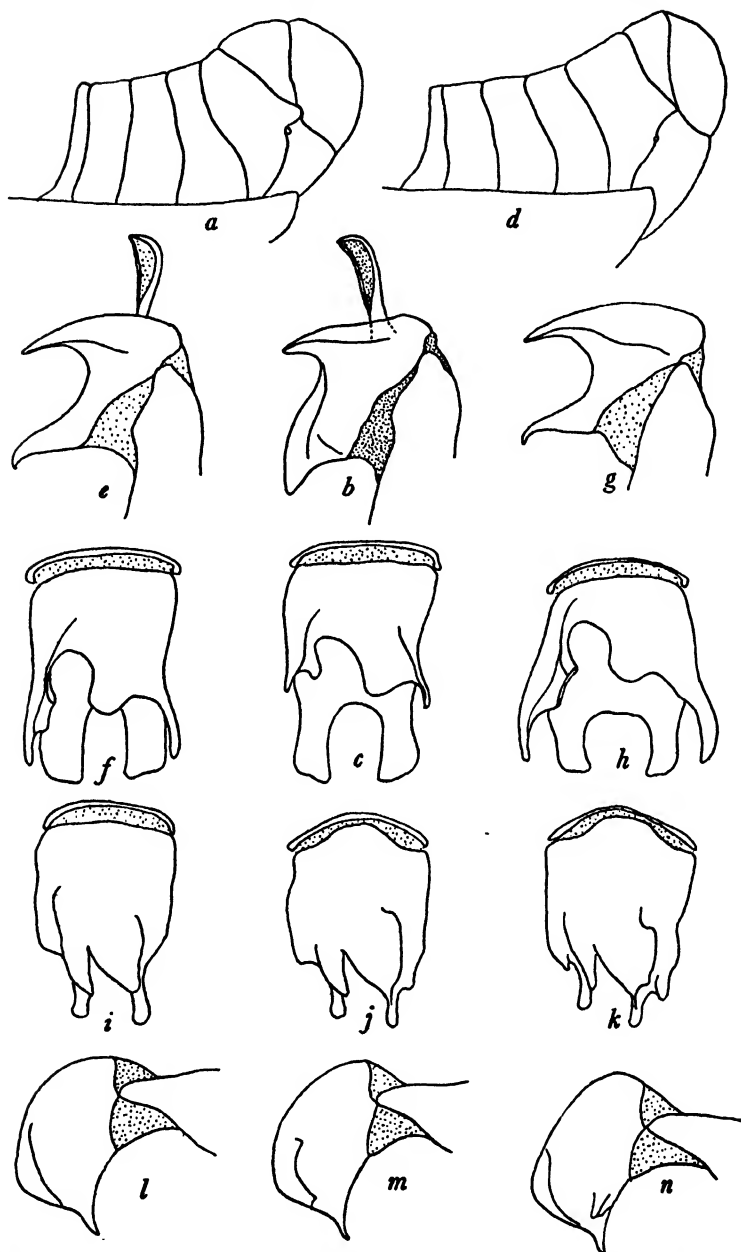


FIGURE 5.—*a-c*, *Phyllophaga (Listrochelus) carminator*: *a*, Lateral view of male abdomen; *b*, lateral view of male genitalia; *c*, en-face view of male genitalia. *d*, *P. (L.) granti*: Lateral view of male abdomen. *e, f*, *P. (L.) densicollis*: *e*, Lateral view of male genitalia; *f*, en-face view of male genitalia. *g, h*, *P. (L.) michelbacheri*: *g*, Lateral view of male genitalia; *h*, en-face view of male genitalia. *i-n*, *P. (L.) miraflores*: *i*, En-face view of male genitalia of variety from Triunfo and San Bartola; *j*, same of typical form; *k*, same of variety from 5 miles south of Miraflores; *l*, lateral view of male genitalia of variety from Triunfo and San Bartola; *m*, same of typical form from Miraflores; *n*, same of variety from 5 miles south of Miraflores.

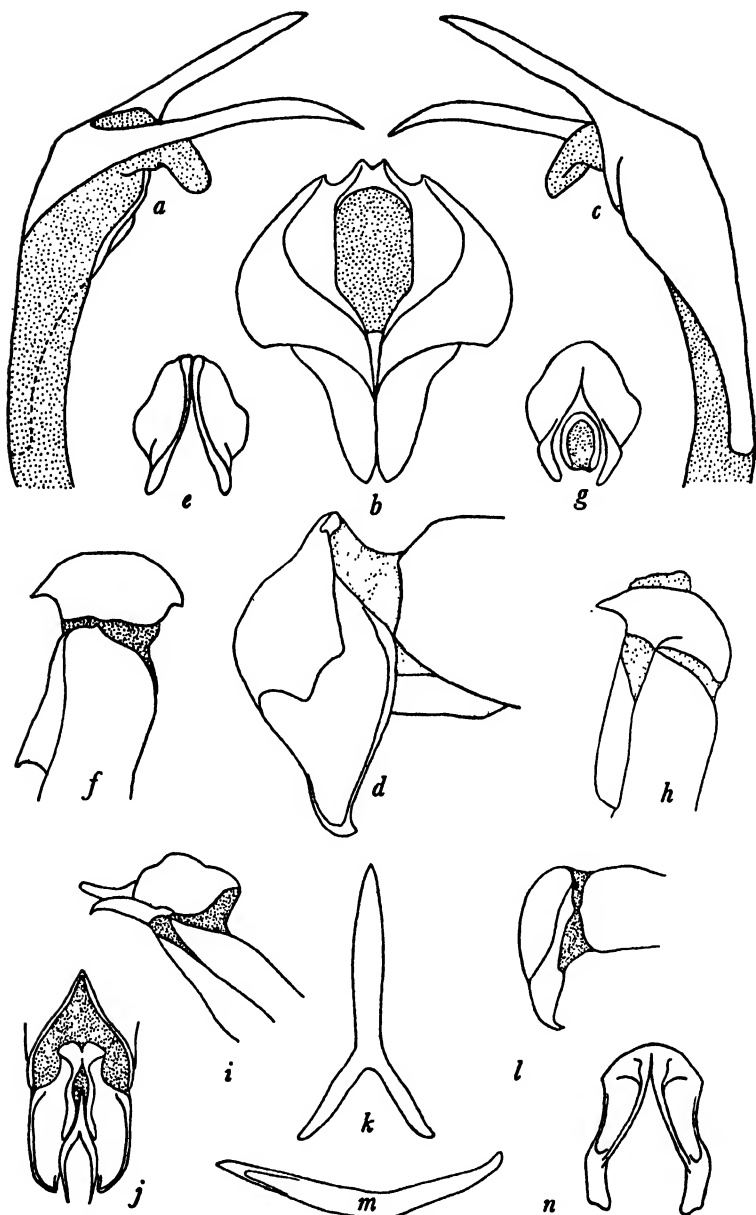


FIGURE 6.—*a-d*, *Phyllophaga (Listrochelus) disparilis*: *a*, *c*, Two views of aedeagus of male; *b*, en-face view of male genitalia; *d*, lateral view of male genitalia. *e, f*, *P. (L.) arizona*: *e*, En-face view of male genitalia; *f*, lateral view of male genitalia. *g, h*, *P. (L.) duncani*: *g*, En-face view of male genitalia; *h*, lateral view of male genitalia. *i, j*, *P. (L.) cushmani*: *i*, Lateral view of male genitalia; *j*, en-face view of male genitalia. *k-n*, *P. (L.) scuticeps*: *k*, Dorsal view of male aedeagus; *l*, lateral view of male genitalia; *m*, lateral view of male aedeagus; *n*, en-face view of male genitalia.

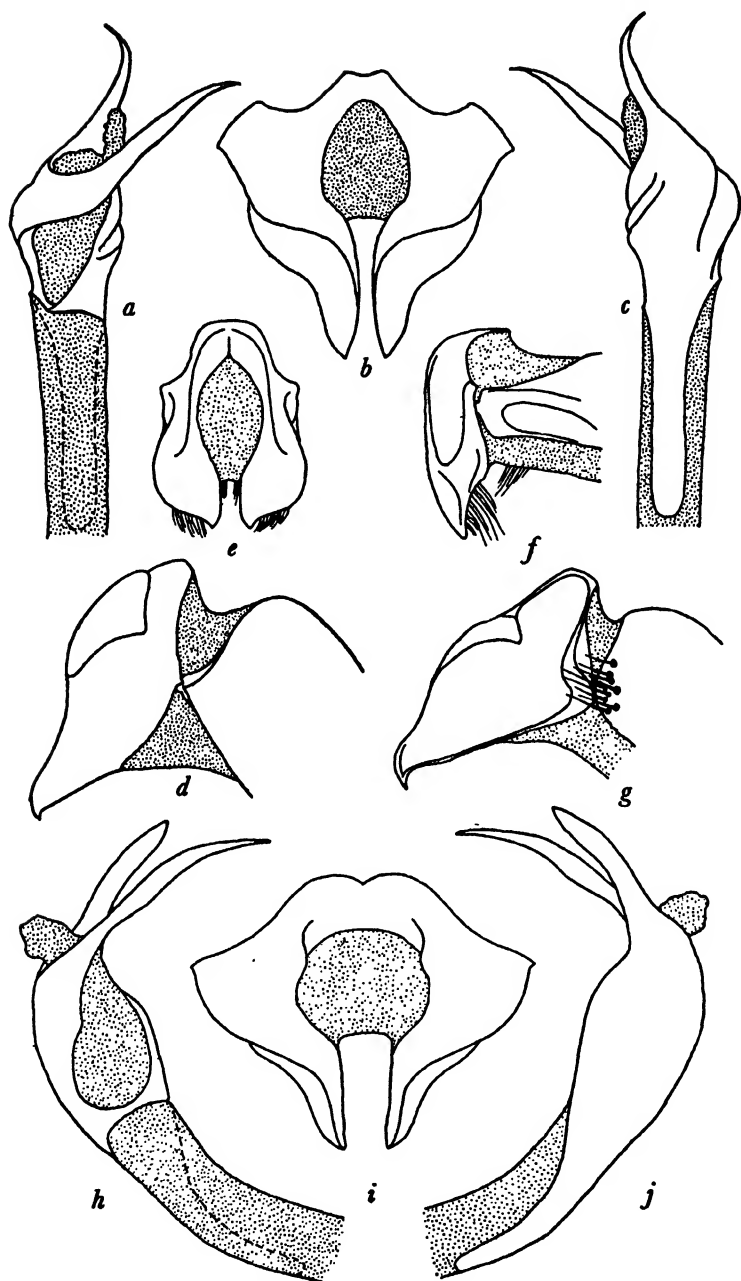


FIGURE 7.—*a-d*, *Phyllophaga (Listrochelus) huachuca*: *a*, *c*, Two views of male aedeagus; *b*, en-face view of male genitalia; *d*, lateral view of male genitalia. *e, f*, *P. (L.) scoparia*: *e*, En-face view of male genitalia; *f*, lateral view of male genitalia. *g-j*, *P. (L.) chapini*: *g*, Lateral view of male genitalia; *h, j*, two views of male aedeagus; *i*, en-face view of male genitalia.

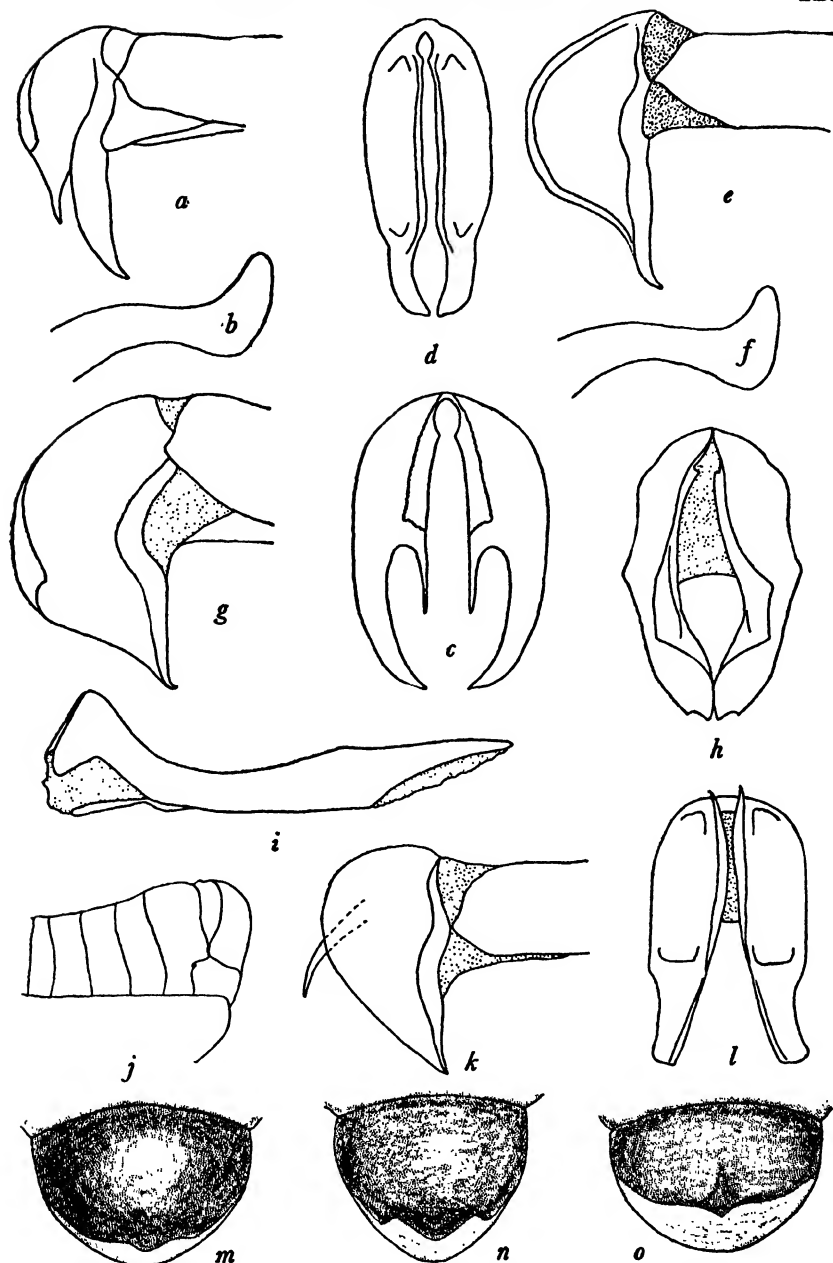


FIGURE 8.—a-c, *Phyllophaga (Listrochelus) reinhardi*: a, Lateral view of male genitalia; b, lateral view of male aedeagus; c, en-face view of male genitalia. d-f, *P. (L.) mucorea*: d, En-face view of male genitalia; e, lateral view of male genitalia; f, lateral view of male aedeagus. g-i, *P. (L.) pulcher*: g, Lateral view of male genitalia; h, en-face view of male genitalia; i, lateral view of male aedeagus. j-l, *P. (L.) plena*: j, lateral view of male abdomen; k, lateral view of male genitalia; l, en-face view of male genitalia. m, *P. (L.) disparilis*: Pygidium of female. n, *P. (L.) huachuca*: Pygidium of female. o, *P. (L.) chapini*: Pygidium of female.

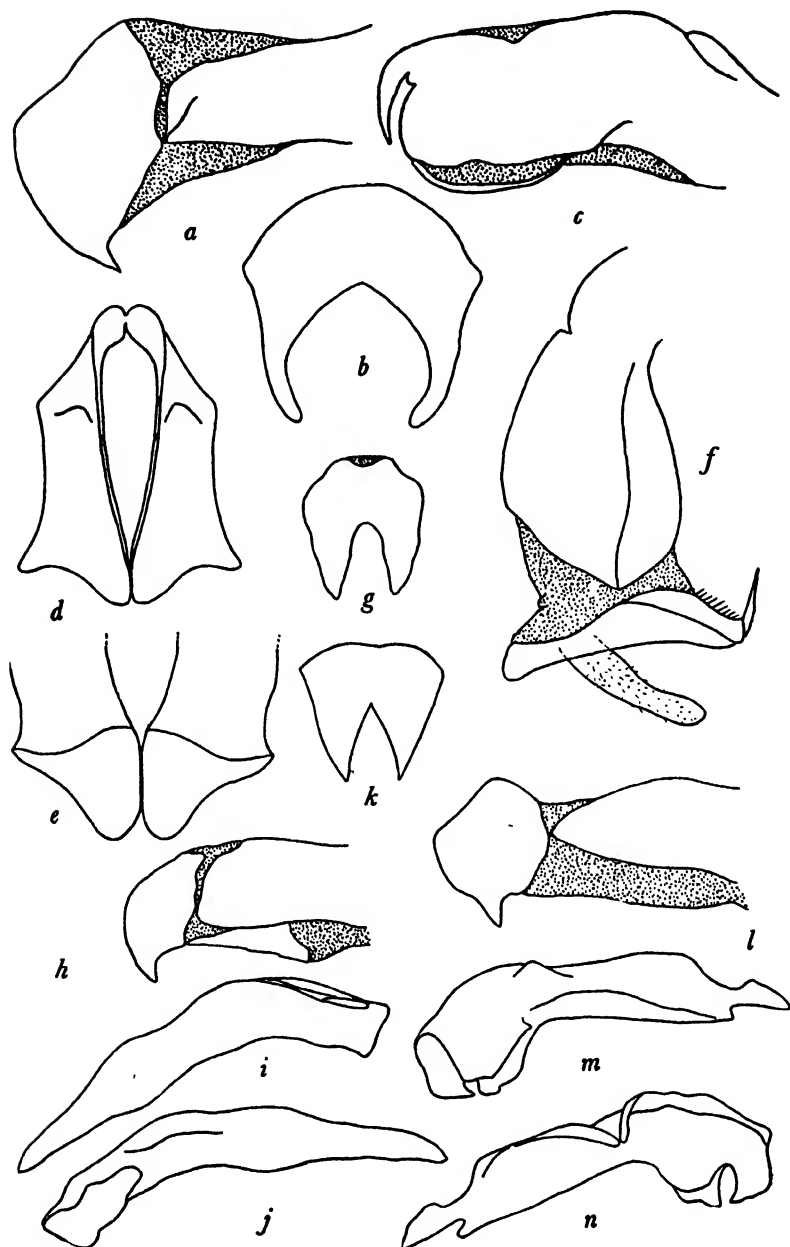


FIGURE 9.—*a-c*, *Phyllophaga (Listrochelus) falsa*: *a*, Lateral view of male genitalia; *b*, en-face view of male genitalia; *c*, lateral view of male genitalia. *d-f*, *P. (L.) trochanter*: *d*, En-face view of male genitalia; *e*, enlarged en-face ventral view of tips of male genitalia; *f*, lateral view of male genitalia. *g-j*, *P. (L.) tarsalis*: *g*, En-face view of male genitalia; *h*, lateral view of male genitalia; *i*, *j*, two views of male aedeagus. *k-n*, *P. (L.) fimbripes*: *k*, En-face view of male genitalia; *l*, lateral view of male genitalia; *m*, *n*, two views of male aedeagus.

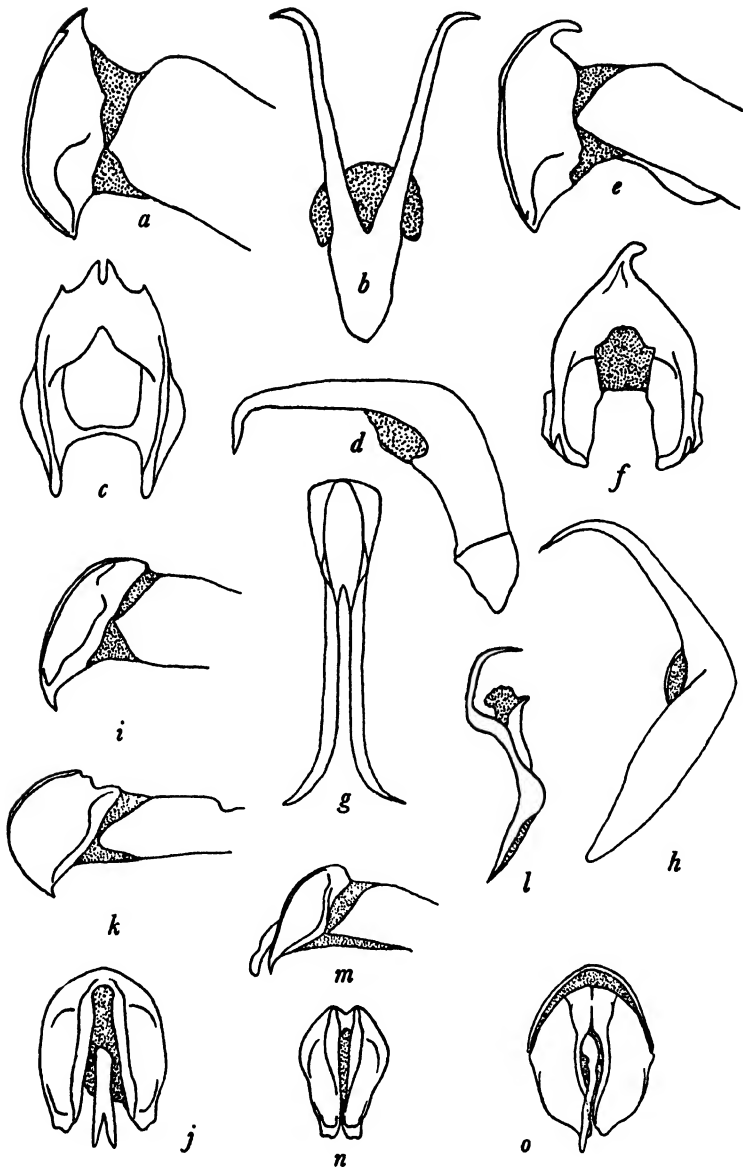


FIGURE 10.—a-d, *Phyllophaga (Listrochelus) flavipennis*: a, Lateral view of male genitalia; b, d, two views of male aedeagus; c, en-face view of male genitalia. e-h, *P. (L.) granti*: e, Lateral view of male genitalia; f, en-face view of male genitalia; g, h, two views of male aedeagus. i, j, *P. (L.) wickhami*: i, Lateral view of male genitalia; j, en-face view of male genitalia. k, l, n, *P. (L.) macmurryi*: k, Lateral view of male genitalia; l, lateral view of male aedeagus; n, en-face view of male genitalia. m, o, *P. (L.) texensis*: m, Lateral view of male genitalia; o, en-face view of male genitalia.

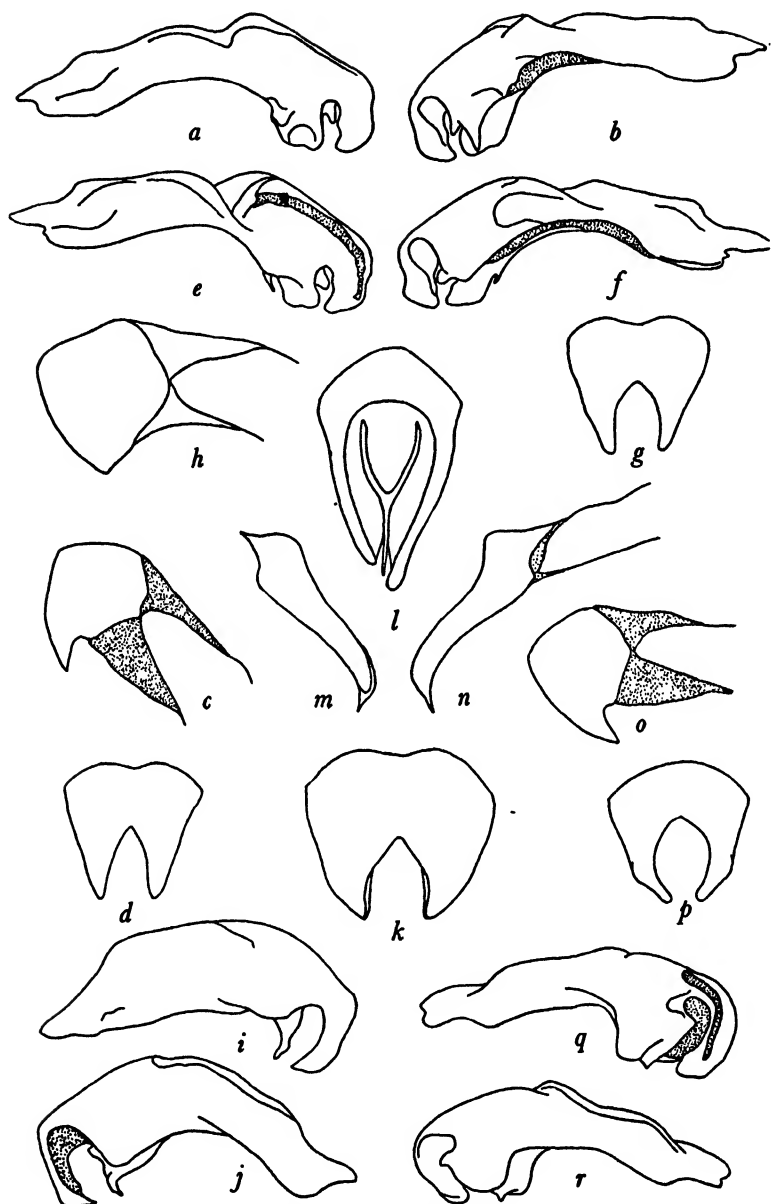


FIGURE 11.—*a-d*, *Phyllophaga* (*Listrochelus*) *koehleriana*: *a*, *b*, Two views of male aedeagus; *c*, lateral view of male genitalia; *d*, en-face view of male genitalia. *e-g*, *P. (L.) neo-mexicana*: *e*, *f*, Two views of male aedeagus; *g*, en-face view of male genitalia. *h-k*, *P. (L.) opacicollis*: *h*, Lateral view of male genitalia; *i*, *j*, two views of male aedeagus; *k*, en-face view of male genitalia. *l-n*, *P. (L.) pilosipes*: *l*, En-face view of male genitalia; *m*, *n*, opposite sides in lateral view of male genitalia. *o-r*, *P. (L.) parilis*: *o*, Lateral view of male genitalia; *p*, en-face view of male genitalia; *q*, *r*, two views of male aedeagus.

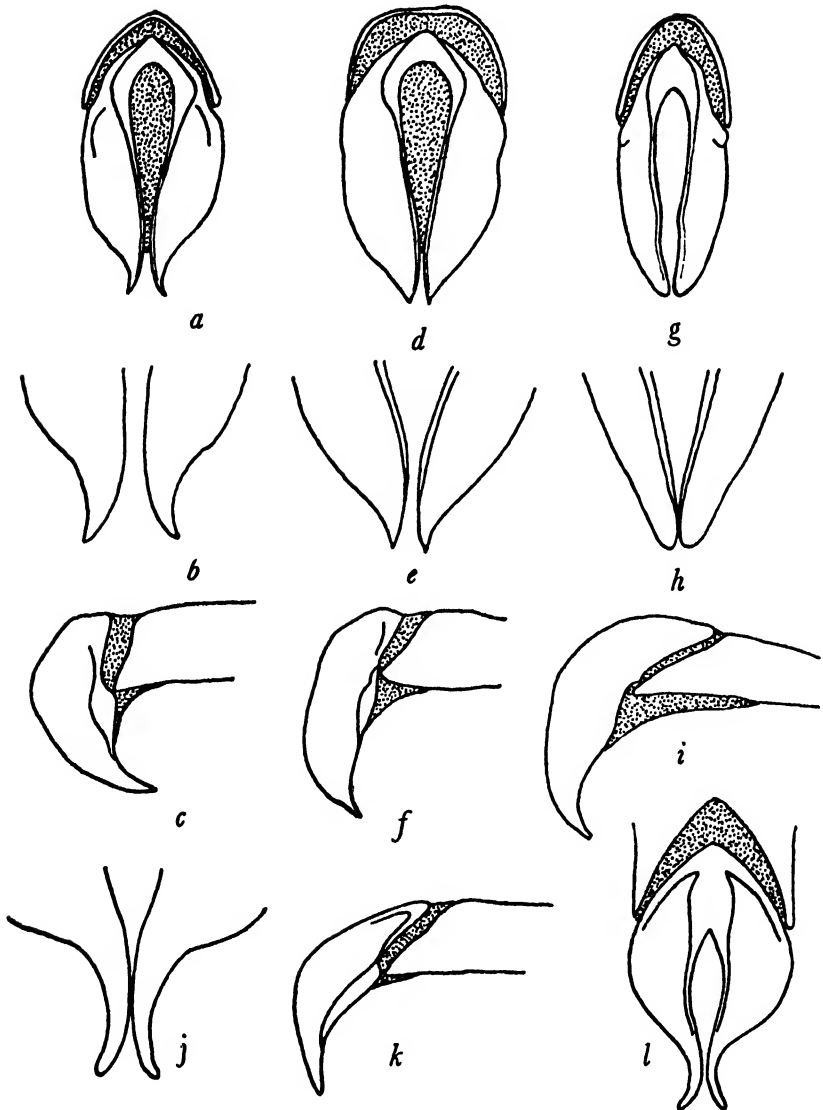


FIGURE 12.—*a-c*, *Phyllophaga (Listrochelus) cochisa*: *a*, En-face view of male genitalia; *b*, enlarged en face-ventral view of tips of male genitalia; *c*, lateral view of male genitalia. *d-f*, *P. (L.) cavata*: *d*, En-face view of male genitalia; *e*, enlarged en face-ventral view of male genitalia; *f*, lateral view of male genitalia. *g-i*, *P. (L.) micros*: *g*, En-face view of male genitalia; *h*, enlarged en face-ventral view of male genitalia; *i*, lateral view of male genitalia. *j-l*, *P. (L.) meadei*: *j*, Enlarged en face-ventral view of male genitalia; *k*, lateral view of male genitalia; *l*, en-face view of male genitalia.

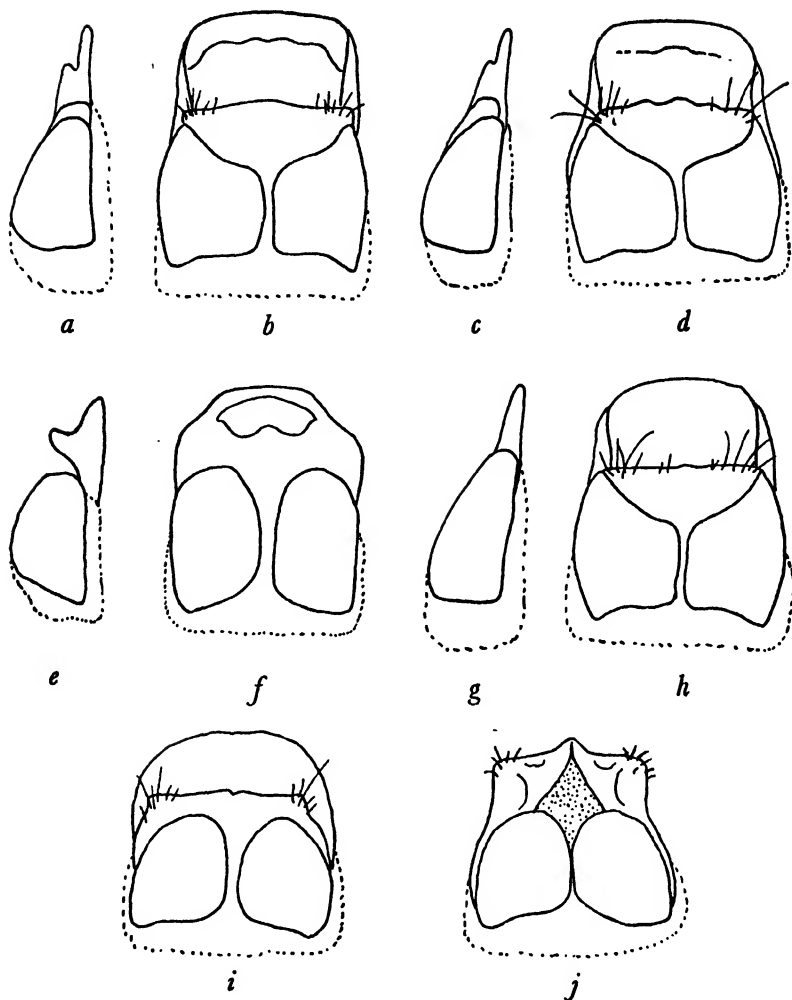


FIGURE 13.—*a, b*, *Phyllophaga (Listrochelus) michelbacheri*: *a*, Lateral view of male genitalia; *b*, en-face view of male genitalia. *c, d*, *P. (L.) densicollis*: *c*, lateral view of female genitalia; *d*, en-face view of female genitalia. *e, f*, *P. (L.) miraflores*: *e*, Lateral view of female genitalia; *f*, en-face view of female genitalia. *g, h*, *P. (L.) carminator*: *g*, Lateral view of female genitalia; *h*, en-face view of female genitalia. *i*, *P. (L.) huachuca*: En-face view of female genitalia. *j*, *P. (L.) granti*: En-face view of female genitalia.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1941

No. 3096

THE CUBAN OPERCULATE LAND MOLLUSKS OF THE
FAMILY ANNULARIIDAE, EXCLUSIVE OF THE SUB-
FAMILY CHONDROPOMINAE

By CARLOS DE LA TORRE and PAUL BARTSCH

IN THE introduction to our monograph on "The Cuban Operculate Land Shells of the Subfamily Chondropominae"¹ we gave a general historic account of the work preceding our effort. The statements made there apply equally to the present paper. We are considering here the remaining subfamilies of the family Annulariidae known to inhabit Cuba, namely, the Rhytidopominae, Adamsiellinae, and Annulariinae.

The differentiations which the members of this family have undergone in Cuba are extraordinary and offer a field for speculation and theorizing unequaled in any other part of the world. We are confining our attention to the taxonomic side of the question, merely calling attention to demonstrable facts without expressing personal opinions regarding the speculative questions involved.

Following Henderson and Bartsch,² we are recognizing four subfamilies in Annulariidae, basing our divisions upon opercular characters.

All annularids have an operculum, consisting of a chondroid basal plate of a varying number of whorls. The whorls composing this plate may be simple, that is, without further differentiation, or they may have a granular calcareous deposit, or bear ribs or lamellae or

¹ Proc. U. S. Nat. Mus., vol. 85, pp. 193-403, figs. 71-101, pls. 7-39, 1938.

² Proc. U. S. Nat. Mus., vol. 58, pp. 49-82, 1920.

combinations of these characters, which easily fall into four categories here recognized as subfamilies.

The first of these subfamilies, the Chondropominae, has a simple chondroid plate consisting of a number of whorls, which usually have more or less of a finely granular calcareous deposit on the outside. In the second, the Rhytidopominae, the whorls bear a calcareous desposit, which may consist of simple, retractively curved riblets that may remain distinct or may become fused at the edge into a solid plate. In the third, the Adamsiellinae, which is poorly represented in Cuba, the upturned outer edge of the preceding whorl is strengthened and built into a strongly elevated lamella by the inner edge of the succeeding turn. This lamella has no ribbing or buttressing. In the fourth subfamily, the Annulariinae, the whorls of the operculum are provided with a strong calcified lamella, which rises from the inner edge of the turns; it may be vertically placed or reflected to parallel the basal plate, and it may be smooth or ribbed. It is usually connected with the basal plate by reenforcement.

The presence or absence of breathing devices of definite type is not restricted to any of the subfamilies; they find service in all of them. These breathing devices vary from a mere notch near the posterior angle of the aperture to a puncture in the parietal wall, which puncture may be further emphasized by having a siphon built on the outside of it. This siphon even may be prolonged and deflected through the suture to the umbilicus, which it closes, and breathing is thus effected through the hollow axis of the shell and through the decolated apex. Or, the columellar wall may have a slit at some distance from the peristome, through which breathing communication is established with the hollow axis.

Another feature, the taxonomic value of which we have not definitely decided upon in this work, is the nuclear sculpture. The embryonic whorls, usually about two, are microscopically granulose, that is, smooth under hand-lens magnification. In two groups, *Limadora* and *Limadorex*, they bear strong definite sculpture; in the first this is thimble pitting, and in the second thimble pitting and spiral threads and axial ribs. In the rest of the shell characters they are not unlike other groups, but in these embryonic features they are widely at variance with the other members of the family.

The three subfamilies here discussed confirm our findings in the Chondropominae: that Cuba represents three centers of development, namely, an eastern, a central, and a western province.

Where we have referred in the keys to closely spaced or axial riblets, the statement refers to the later whorls.

We have used brackets around certain names to indicate that the original describer gave credit for the species to the one whose name appears in brackets, for example ([Gundlach] Pfeiffer).

In conclusion, we wish to express again our thanks and appreciation to all the institutions and individuals acknowledged in our former paper. Without their continued help this monograph would have been incomplete.

Subfamily RHYTIDOPOMINAE Henderson and Bartsch

1920. Rhytidopominae HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 64-65.

Shell ranging from elongate-conic through ovate to turbate. Axial ribs are always present; they may vary from mere threads to lamellae; they may terminate simply; they may become expanded at the summit into broad denticles or even fused there into hollow cusps or tufts. Spiral threads may be present on spire, base, and umbilicus, or in the umbilicus only, or they may be even entirely absent. The last whorl may be adnate or solute and the umbilicus may be open or closed. The operculum has as a basis a chondroid plate composed of several whorls, the outer surface of which bears numerous, retractively slanting, raised lamellae, which vary greatly in strength in the different genera. They may extend completely across each whorl or they may cover only a part of it, as in *Opisthosiphon*. These lamellae may or may not be fused on their inner and outer termination. They may be rather distantly spaced or they may be almost fused at their edge. Special devices for breathing when the operculum closes the shell may be present or absent. They show an enormous range of specialized development, which will be discussed under each genus.

Type genus.—*Rhytidopoma* Sykes.

KEY TO THE GENERA OF THE SUBFAMILY RHYTIDOPOMINAE

Breathing device present.

Breathing siphon present.

Siphon complete.

Lamellae of the operculum extending completely across the whorl..... **Opisthocoelicum**

Lamellae of the operculum not extending completely across the whorl.

Lamellae of the operculum fused at their inner and outer edge to form a spiral keel.

Lamellae between the inner and outer keel as high as the keels..... **Torrella**

Lamellae between the inner and outer keel not as high as the keels, but concave at the free edge..... **Rhytidopoma**

Lamellae of the operculum not fused at their outer edge..... **Opisthosiphon**

Siphon incomplete..... **Dallsiphona**

Breathing siphon absent.

Breathing puncture present.

Breathing pore communicating with the space behind
the withdrawn operculum..... **Xenopomoides**

Breathing pore communicating with a channel at the
posterior angle of the aperture connecting with the
hollow axis somewhere behind the peristome.....

Rhytidothyra

Breathing device absent.

Last whorl of operculum covered by an overarching dome.... **Xenopoma**

Last whorl of operculum not covered by an overarching dome..

Parachondria

OPISTHOCOELICUM, new genus

In this genus the operculum resembles that of *Rhytidothyra*, i. e., the reinforcements on the outside consist of strongly raised, retractorily curved lamellar ribs, which extend completely across the turns (they are not separated by a channel as they are in *Opisthosiphon*). A siphon is present immediately behind the peristome, at the posterior angle of the aperture. This siphon bends into the suture, and it connects with the umbilicus by a channel behind the expanded outer peristome.

Type.—*Opisthocoelicum* (*Opisthocoelicum*) *opisthocoele*, new species.

The genus appears to be confined to the provinces of Santa Clara and Camagüey.

We are recognizing three subgenera, which the following key will help to distinguish:

KEY TO THE SUBGENERA OF OPISTHOCOELICUM

Operculum too large to be withdrawn into the shell..... **Opisthocoelex**

Operculum not too large to be withdrawn into the shell.

Axial ribs gathered into hollow tufts at the summit..... **Opisthocoelops**

Axial ribs not gathered into hollow tufts at the summit.....

Opisthocoelicum

OPISTHOCOELEX, new subgenus

In this subgenus the inner peristome is much exerted and the operculum is much too large to be withdrawn into the shell, which it merely caps. The retractorily curved lamellae on the outside of the operculum are fused laterally to form an almost continuous plate, resembling somewhat the operculum of *Colobostylus* of Jamaica. The breathing device is the same as in typical *Opisthocoelicum*. In the present subgenus the axial ribs are thickened at the summit, but they are not gathered into tufts.

Type: *Opisthocoelicum* (*Opisthocoelex*) *paradoxum* (Torre and Henderson).

KEY TO THE SPECIES OF THE SUBGENUS OPISTHOCOELEX

Axial ribs closely spaced.....	paradoxum
Axial ribs distantly spaced.....	simulans

OPISTHOCOELICUM (OPISTHOCOELEX) PARADOXUM (Torre and Henderson)

Shell elongate-ovate, pale yellow, unicolor or marked by narrow, feebly interrupted spiral bands of brown, the elements of which are arranged in both axial and spiral series. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. The postnuclear whorls are well rounded, the early ones marked by lamellar, scalloped, distantly spaced axial ribs. These ribs become more approximated on the middle turns and quite closely spaced on the last whorl, where they are separated by spaces not so wide as the ribs. The scallops on the whorls are more strongly developed at the summit than at the periphery, and on the early whorls the scallops at the periphery interlock with those at the summit of the succeeding turn. The scallops are absent on the last turn. Suture well impressed. Periphery strongly rounded. Base rather long, strongly rounded, and marked by the continuations of the axial ribs, which extend into the umbilical area, and by several spiral cords on the parietal wall near the umbilical edge. The last whorl is decidedly solute and the part between the parietal peristome and the preceding turn is covered by a strong callus, which extends also over the umbilicus, which it covers. This callus is pinched in at the edge and is marked by slender, concentric laminae. Aperture subcircular. Peristome simple, thin. The operculum is heavy and large, and it extends beyond the edge of the peristome; it cannot be withdrawn into the aperture. The operculum has an almost subcentral nucleus, and is marked by retractively curved radiating ridges, which extend to the periphery of the whorl, and which become fused with the equivalent sculpture of the succeeding turns. These radiating ridges are also fused laterally to form a solid plate, as in *Colobostylus*. The siphon at the posterior angle of the aperture passes into a varicial thickening behind the aperture, which connects by a channel with the umbilicus, and breathing is established through the hollow axis and the decollated tip of the shell.

This species appears to range along the southern plain of the Cubitas Mountains.

We are recognizing three subspecies as follows:

KEY TO THE SUBSPECIES OF OPISTHOCOELICUM (OPISTHOCOELEX) PARADOXUM

Shell small, length of decollated shell less than 11 mm.....	paradoxum
Shell larger, length of decollated shell more than 13 mm.	
Whorls strongly rounded.....	gibbosum
Whorls slightly rounded.....	magnum

OPISTHOCOELICUM (OPISTHOCOELEX) PARADOXUM PARADOXUM (Torre and Henderson)

PLATE 9, FIGURE 2

1921. *Eutudora (Eutudorops) paradoxum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 264, pl. 42, figs. 8, 9.

This race was collected by Dr. de la Torre at Monte de Santa Cruz, Camagüey Province. It is smaller than the other races and has the sculpture very pronounced, in which respect it resembles *O. (O.) paradoxum gibbosum*, but from which it is distinguished by having the axial ribs uniformly developed; that is, there are no groups of 3 or 4 heavier riblets succeeded by an equal number of finer riblets.

The type, U.S.N.M. No. 314964, a female, has 4.3 whorls and measures: Length, 10.8 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.25 mm.

A male from the same lot, a complete specimen having 6.3 whorls, measures: Length, 10.0 mm.; greater diameter, 5.1 mm.; lesser diameter, 4.75 mm.

OPISTHOCOELICUM (OPISTHOCOELEX) PARADOXUM GIBBOSUM, new subspecies

PLATE 9, FIGURE 3

This race was collected by Bartsch at Sitio Afuera, at the south exit of Paso de la Escalera of the Cubitas Mountains, Camagüey Province. It is a large one. The whorls are decidedly inflated and rounded, and the axial ribs on the middle turns are spaced in alternating groups of coarse and fine riblets.

The type, U.S.N.M. No. 535342, has 4.5 whorls remaining and measures: Length, 13.3 mm.; greater diameter, 7.0 mm.; lesser diameter, 6.7 mm.

OPISTHOCOELICUM (OPISTHOCOELEX) PARADOXUM MAGNUM, new subspecies

PLATE 9, FIGURE 3

This is a large race that Bartsch collected at Finca Gertrudis, at the foothills of the Cubitas Mountains, Camagüey Province. It is easily distinguished from the other two by its much less strongly developed sculpture and by its much less rotund whorls. The shell is also marked by very feeble, interrupted spiral bands of brown, which are rather closely spaced, and which are also arranged in very widely spaced axial series.

The type, U.S.N.M. No. 535341, has 5.0 whorls remaining and measures: Length, 13.4 mm.; greater diameter, 6.7 mm.; lesser diameter, 6.0 mm.

OPISTHOCOELICUM (OPISTHOCOELEX) SIMULANS, new species

PLATE 9, FIGURE 4

Shell elongate-ovate, of pale orange color, with the nuclear whorls and peristome paler. Nuclear whorls 2, very strongly inflated and very strongly rounded, separated by a very deep suture; smooth, except for microscopic granulations. Postnuclear whorls inflated, strongly rounded, and marked by very strong, rather distantly spaced, lamellar axial ribs, which are rendered slightly scalloped on the early whorls and obsoletely nodulose on the last turn. These axial lamellar ribs extend strongly from the summit to the umbilical area. At the summit of the turns they interlock somewhat with the lamellae of the preceding turn. In addition to these strong axial lamellae, of which 25 occur upon the last whorl, the whorls are marked by an occasional intercalated finer axial cord and by numerous exceedingly fine, microscopic, somewhat wavy axial lirations. Suture very strongly constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, and marked by the same axial sculpture that characterizes the spire, which extends into the umbilicus. The umbilicus is bordered by a spiral cord, with a second cord on the umbilical wall halfway between this and the reflected callus. Peristome double, the outer broadly expanded on the posterior portion of the outer lip and the parietal wall, forming a somewhat backward-turned auricle at the posterior angle, narrower on the basal and columellar walls. On the columellar wall the outer lip is reflected backward over the umbilicus and on the parietal wall it extends across a large gap covering the umbilical area and it is pinched in at the outer edge of the umbilicus. The outer peristome is marked by a series of wavy, concentric lamellae; the inner peristome is slightly exerted. There is a puncture in the parietal wall near the posterior angle, which communicates with the short, backward-turned siphon immediately behind the outer lip. The operculum is too large to be withdrawn within the aperture. The lamellae of the early turns are distinct as in *Parachondria*, but they cover the entire whorl. On the last turn these lamellae become fused to form a solid plate, marked by the indications of the lamellae.

The type, U.S.N.M. No. 535343, was collected by Bartsch at Finca Los Cangilones at the foothills of the Cubitas Mountains, Camagüey Province. It has 3.5 whorls remaining and measures: Length, 9.2 mm.; greater diameter, 5.9 mm.; lesser diameter, 5.0 mm.

He found this species also on the paredones on the east side of the Vereda de Los Burros, 1.5 km. north of Finca San Clemente, Cubitas Mountains.

OPISTHOCOELOPS, new subgenus

In this subgenus the operculum and the breathing device are like those of *Opisthocoelex*. The outer peristome is also broadly expanded, as in *Opisthocoelex*, but it frequently does not completely close the umbilicus. The axial ribs are gathered into conspicuous hollow tufts at the summit.

Type: *Opisthocoelelicum* (*Opisthocoelops*) *excurrens* ([Gundlach] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS OPISTHOCOELOPS

Posterior angle of aperture strongly auriculated.....	occultum
Posterior angle of aperture not strongly auriculated.....	excurrens

OPISTHOCOELICUM (OPISTHOCOELOPS) OCCULTUM (Torre and Henderson)

PLATE 9, FIGURE 7

1920. *Opisthosiphon* (*Opisthosiphona*) *occultus* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.
 1921. *Opisthosiphon* (*Opisthosiphona*) *occultum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 258-259, pl. 41, figs. 4, 6, 7.

Shell elongate-conic, flesh colored, sometimes pale brown with interrupted spiral bands of brown; the elements composing these bands are rather distantly spaced and they are arranged in both axial and spiral series; the peristome is flesh colored, the outer rayed on the outer lip by the spiral bands of brown. Nuclear whorls 1.7, small, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls somewhat inflated, strongly rounded, marked by slender, slightly wavy, retractively curved axial riblets, which are rather distantly spaced on the first turn and which become gradually more closely approximated as the shell increases in size; on the last turn the spaces that separate the riblets are narrower than the riblets. Of these ribs, 30 occur upon the first turn, 62 upon the second, 118 upon the third, and 130 upon the last turn of the type. At more or less regular intervals some of these riblets are gathered into rather poorly developed hollow tufts at the summit. The riblets between these tufts are shorter than the rest. Suture strongly constricted. Periphery well rounded. Base short, strongly rounded, marked by the continuation of the axial ribs, and within the umbilicus by slender spiral cords. Aperture broadly oval; peristome double, the inner slightly exerted and reflected; the outer broadly, somewhat flaringly expanded, deeply notched on the middle of the inner lip; posterior to the notch the outer peristome is reflected over the umbilicus, which it completely covers, on the parietal wall the outer peristome is adnate to the preceding turn, while at the posterior angle it forms a conspicuous auricle, which is rendered somewhat irregular by the siphon immediately behind it; on the outer and basal lip it is a trifle narrower

than on the rest of the aperture; the outer peristome is marked by slender concentric lamellae. Operculum as described for the species.

The type, U.S.N.M. No. 314957, was collected by Mrs. Reed on Loma de Borje, Sierra de Cubitas Mountains, Camagüey Province. It has a little over 4 whorls and measures: Length, 13.8 mm.; greater diameter, 7.9 mm.; lesser diameter, 6.5 mm.

Bartsch also collected this species at Loma La Caridad de Mendoza and Loma de Santa Cruz, near the Central Senado.

The strong auricle and the more rounded whorls will readily distinguish this species from *Opisthocoelicum* (*Opisthocoelops*) *excurrens* ([Gundlach] Pfeiffer).

OPISTHOCOELICUM (OPISTHOCOELOPS) EXCURRENS ([Gundlach] Pfeiffer)

PLATE 9, FIGURE 1

1860. *Cyclostoma* (*Tudora*) *excurrens* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 7, p. 29.

1861. *Tudora excurrens* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1890. *Cyclostoma excurrens* CROSSE, Journ. Conchyl., vol. 38, p. 301.

1920. *Opisthosiphon* (*Opisthosiphona*) *excurrens* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Shell elongate-conic, pale brown with interrupted spiral bands of chestnut-brown; the elements composing these bands are arranged in both axial and spiral series; interior of the aperture yellowish white, conspicuously rayed by the spiral bands, which also extend faintly upon the yellowish-white outer peristome of the outer lip. Nuclear whorls decollated in all our specimens. Postnuclear whorls almost flattened, marked by slender, somewhat retractively slanting axial riblets, which are distantly spaced on the first of the remaining turns, and which gradually become more closely spaced, until on the last whorl they are separated by spaces which are mere impressed lines. Of these riblets, 38 occur upon the first of the remaining turns, 70 upon the second, 136 upon the third, and 164 upon the last. Some of the riblets extend very prominently to the summit, where some become fused to form tufts or hollow cusps, which are appressed to the expanded basal peripheral portion of the ribs of the preceding turn; some of the riblets do not become expanded, and these usually terminate at some little distance anterior to the stronger expanded ones. On the penultimate turn the axial ribs become conspicuously expanded at the periphery. Suture not very strongly contracted. Periphery moderately rounded. Base rather long, moderately rounded, marked by the continuation of the axial ribs and by 2 strong spiral cords immediately adjacent to the umbilicus, and by 3 others, a little weaker, between the outer of the spiral cords and the periphery. The aperture

is broadly oval; peristome double, the outer broadly expanded, a little more so on the inner lip than on the outer, widest at the umbilicus, over which it is reflected and broadly expanded on the parietal wall, where it is adnate to the preceding turn; an inconspicuous auricle at the posterior angle is made irregular by the siphon, which is reflected backward, and which is appressed to the suture; the inner peristome is slightly exserted and slightly expanded. Operculum paucispiral, with the nucleus halfway between submarginal and subcentral; the turns are marked by retractively slanting, slender lamellae, which are fused on the outer border as well as on the inner one.

The specimen described and figured, U.S.N.M. No. 355467, is one of three received from Poey, collected by Gundlach at Nuevitas. It has a little over 4 whorls and measures: Length, 13.6 mm.; greater diameter, 7.2 mm.; lesser diameter, 5.8 mm.

The much flatter whorls and the weak auriculation at the posterior angle of the aperture will readily distinguish this from *Opisthocoele* (*Opisthocoele*) *occultum* (Torre and Henderson).

OPISTHOCOELICUM, new subgenus

This subgenus is distinguished from the subgenus *Opisthocoele* by having the inner peristome scarcely at all exserted and by having the operculum withdrawable into the aperture, with the lamellae distinct. The umbilicus in adult shells is closed by the reflection of the outer peristome of the inner lip. When the operculum closes the shell, breathing may be accomplished through the puncture at the posterior angle of the aperture, which communicates with the hollow siphon, and which in turn bends into the suture, where it connects with a small channel behind the expanded outer peristome of the parietal wall, which leads to the umbilicus; the hollow axis and the narrow opening at the decollated apex furnish contact with the exterior.

Type: *Opisthocoele* (*Opisthocoele*) *opisthocoele*, new species.

KEY TO THE SPECIES OF THE SUBGENUS OPISTHOCOELICUM

Axial ribs closely spaced.....	<i>opisthocoele</i>
Axial distantly spaced.....	<i>lamellicostatum</i>

OPISTHOCOELICUM (OPISTHOCOELICUM) OPISTHOCOELE, new species

PLATE 9, FIGURE 8

Shell moderately large, ovate-conic, ranging from white to pale wax yellow. Nuclear whorls 2, decidedly inflated, strongly rounded, microscopically granulose, forming an almost truncated mammillated apex. Postnuclear whorls well rounded, the early ones marked by rather distantly spaced, lamellar axial riblets, which become expanded at the summit and suture; where summit and suture meet the riblets

interdigitate. These riblets are less elevated on the later turns; they are more distantly spaced on the early turns, and they become increasingly more approximated. Thirty-three are present on the first of the remaining turns, 44 on the second, 69 on the third, 103 on the fourth, and 102 on the last. The early whorls show by their slight waviness and scalloping indications of spiral sculpture, which evanesces on the later turns. Suture moderately constricted. Periphery well rounded. Base rather long, well rounded, and marked by the continuation of the axial riblets and by 4 spiral cords, which are of equal strength and spacing. The third of these marks the periphery of the closed umbilicus, while the last one is on the umbilical wall. These spiral cords render the axial riblets crenulated at their junction. Aperture broadly ovate; peristome double, the outer flaringly expanded, pinched in on the columellar wall to close the umbilicus, and narrower on the parietal wall than on the rest of the peristome; the inner slightly exerted, slightly reflected and appressed to the outer. The siphon and operculum of this species are described under the genus.

The type, U.S.N.M. No. 535480, was collected by Torre at El Purio, Encrucijada, Santa Clara Province. It has 5 whorls remaining and measures: Length, 12 mm.; greater diameter, 15.7 mm.; lesser diameter, 5.1 mm.

A young, half-grown specimen shows a wide-open umbilicus.

This species is rather widely distributed in Santa Clara Province. In addition to the type locality and the regions adjacent to this, we have seen it from Loma Batey del Ingenio Santa Clara, near Calabazar; Cueva Galana, Finca Miradero, Loma Ortiz, La Viruela; La Sierra, Loma Sola, Potrero Penton, Loma Chicharron near Vega Alta, and Las Jumaguas near Sagua.

Description of the animal of specimens collected by Bartsch at Potrero Penton is as follows: The upper portion flesh colored, with many fine dots of gray, with a pinkish area behind the tentacles, which are grayish flesh colored tipped with pale lemon yellow; the sides of the body are pale olivaceous, which is also the color of the tip of the snout and of the deeply cleft sole of the foot. The animal moves either with a direct motion or with a lateral jerk of the shell.

OPISTHOCOELICUM (OPISTHOCOELICUM) LAMELLICOSTATUM (Torre and Henderson)

Shell elongate-ovate, ranging in color from pale yellow to pale brown. Nuclear whorls 2, well rounded, microscopically granulose, forming a somewhat truncated apex. Postnuclear whorls inflated, strongly rounded, marked by lamellar or sublamellar axial ribs, which are slightly or decidedly fluted. This fluting is best expressed on the early whorls. The ribs become expanded at the summit into conspicuous auriclelike denticles, which usually touch the axial ribs of the preceding turn. The intercostal spaces are much wider than

the ribs and they are marked by microscopic axial threads; no spiral threads are present on the spire. Suture strongly constricted. Periphery somewhat inflated, well rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs, which extend to the plugged umbilicus. Outside of the umbilical closure there are 3 or 4 spiral cords, which render the axial ribs decidedly scalloped at their junction. Aperture very broadly oval, almost subcircular; peristome double, the inner somewhat exerted, not reflected; the outer broadly expanded and marked by concentric lamellae, deeply notched on the inner lip, posterior to which it is reflected into the umbilicus, which it plugs. Operculum and siphon typically opisthocelid.

We are recognizing two subspecies, which the following key and descriptions will differentiate:

KEY TO THE SUBSPECIES OF OPISTHOCOELICUM (OPISTHOCOELICUM) LAMELLICOSTATUM

Axial ribs decidedly lamellar and decidedly scalloped..... *mabuyense*
 Axial ribs not decidedly lamellar or decidedly scalloped..... *lamellicostatatum*

OPISTHOCOELICUM (OPISTHOCOELICUM) LAMELLICOSTATUM MABUYENSE, new
 subspecies

PLATE 9, FIGURE 6

This race comes from Mabuya, near Florencia, Camagüey Province. It differs from typical *O. (O.) lamellicostatatum lamellicostatatum* in being of much darker color and in having the axial ribs decidedly lamellar and decidedly scalloped.

The type, U.S.N.M. No. 535481, has 24 axial ribs on the first of the remaining turns and 34 on the last; it has 4.2 whorls remaining and measures: Length, 11.2 mm.; greater diameter, 6.6 mm.; lesser diameter, 5.0 mm.

OPISTHOCOELICUM (OPISTHOCOELICUM) LAMELLICOSTATUM LAMELLICOSTATUM
 (Torre and Henderson)

PLATE 9, FIGURE 5

1921. *Opisthosiphon (Opisthosiphon) lamellicostatatum* TORRE and HENDERSON,
 Proc. U. S. Nat. Mus., vol. 59, pp. 263-264, pl. 42, figs. 6, 7.

This, the typical race, was collected by Torre at Boqueron del Jatibonico on the boundary of Santa Clara Province. It is easily distinguished from the other subspecies by its less strongly developed axial ribs, which are also much less scalloped.

The type, U.S.N.M. No. 314963, has 25 axial ribs on the first of the remaining turns and 65 on the last; it has 4.2 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.5 mm.

Genus *TORRELLA* Henderson and Bartsch

1920. *Torrella* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

Shell elongate-conic, marked by sublamellar axial riblets only on the spire, or by sublamellar axial riblets and by obsolete spiral threads. The umbilicus may be marked by weak or strong spiral cords. Peristome double, the outer expanded, simple or fimbriated. Breathing siphons almost straight or decidedly flexed and bent into the umbilicus. Operculum with the ribs occupying only a portion of each whorl and as high as the inner and outer lamellae, which are formed by the fusing of the ribs.

Type: *Torrella* (*Torrella*) *torreiana* ([Gundlach] Arango).

KEY TO THE SUBGENERA OF *TORRELLA*

Siphon bending into the umbilicus and plugging the hollow axis..... *Torrella*
Siphon not bending into the umbilicus or plugging the hollow axis.. *Torrellisca*

Subgenus *TORRELLA* Henderson and Bartsch

1920. *Torrella* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

Shell elongate-conic, marked by slender, sublamellar axial ribs and by obsolete spiral cords. The latter render the ribs somewhat sinuous and slightly foliate at their junction. Umbilicus marked by strong spiral cords. Outer peristome expanded and fimbriated at the edge. Breathing siphon strongly flexed and bent into the umbilicus, which it completely closes. Breathing, when the animal is withdrawn, is effected through the hollow axis of the shell and through the decollated apex. Operculum typically torrellid.

Type: *Torrella* (*Torrella*) *torreiana* ([Gundlach] Arango).

KEY TO THE SPECIES OF THE SUBGENUS *TORRELLA*

Fimbriations of the outer peristome pronounced.

Inner lip of outer peristome decidedly fimbriated..... *torreiana*

Inner lip of outer peristome not decidedly fimbriated..... *deficiens*

Fimbriations of outer peristome scarcely indicated..... *immersa*

TORRELLA (*TORRELLA*) *TORREIANA* ([Gundlach] Arango)

PLATE 10, FIGURE 1

1878. *Ctenopoma torreianum* [Gundlach] ARANGO, Contribucion a la fauna malacologica Cubana, p. 18.

1920. *Torrella* (*Torrella*) *torreiana* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

Shell elongate-conic, milk white. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by very strongly developed, lamellose, slightly retractively slanting,

hollow axial ribs, of which 48 occur on the first, 64 on the second, and 78 on the last of the remaining turns in the cotype described and figured. Most of these axial riblets become expanded into broad auricles at the summit, although occasionally they do not. The spiral sculpture consists of slender threads, of which 7 are present on all the whorls. The spiral threads at their junction with the axial ribs render the latter decidedly wavy and frequently hispid. Suture strongly constricted. The sutural space is crossed by the auricles of the expanded ribs, which become attached to the preceding turn. Base short, broadly rounded, widely umbilicated, marked by the continuation of the axial ribs and by about 7 spiral threads. These threads are much stronger at the outer edge of the umbilicus than they are within the umbilicus or posterior to it. At the umbilical angle they render the axial riblets decidedly scalloped. Last whorl solute for about one-third of a turn. Aperture broadly oval; peristome double, the outer moderately broadly expanded and strongly digitate; 9 digitations about as wide as the spaces that separate them are present on the outer and basal lip; on the inner lip 4 weaker digitations are present, while on the parietal wall they are absent. These digitations show concentric laminae; inner peristome slightly exserted. Operculum typically torrellid. The breathing siphon begins immediately behind the peristome at the posterior angle of the aperture and it is reflected as a slender, twisted, corrugated tube into the umbilicus, which it completely plugs.

A cotype received from Dr. de la Torre, U.S.N.M. No. 355529, comes from El Mogote, near Ceiba Mocha, Matanzas Province. It has 3.5 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 4.8 mm.; lesser diameter, 3.9 mm.

This species can easily be distinguished from the others by the extremely strong digitations of the outer peristome.

TORRELLA (TORRELLA) DEFICIENS [(Gundlach) Pfeiffer]

PLATE 10, FIGURE 4

1857. *Cyclostoma deficiens* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 4, p. 42.
1858. *Ctenopoma deficiens* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 104.
1920. *Torrella (Torrella) deficiens* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

Shell elongate-conic, flesh colored. Nuclear whorls 2, strongly inflated, well rounded, microscopically granulose, forming a mammillated apex. Postnuclear whorls inflated, strongly rounded, marked by almost vertical, slender, hollow, retractively curved axial ribs, of which 61 occur upon the first of the remaining turns in the cotype

figured, 102 on the second, and 104 on the last. These ribs are expanded into auricles at the summit. The spiral sculpture consists of slender threads, of which 5 occur on the first and second of the remaining turns, and 6 on the last between the summit and periphery. Suture strongly constricted, bridged over by the auricles of the ribs. Periphery well rounded. Base short, inflated, well rounded, widely umbilicated, marked by the strong continuation of the axial ribs and by spiral threads, of which 5 are present between the periphery and the edge of the umbilicus, and 3 within the umbilicus; those at the edge of the umbilicus are much stronger than the rest and they render the riblets scalloped at the edge. Last whorl solute for about one-third of a turn. Aperture broadly oval; peristome double, the inner moderately exerted and slightly expanded; the outer moderately broadly expanded, strongly fluted at the junction of the inner and basal angle, and less so on the outer and inner lips, marked by concentric laminae. Operculum typically torrellid. The breathing siphon has its origin immediately behind the peristome and it is reflected into the umbilicus as a slightly twisted, tapering tube, which completely plugs the umbilicus.

The specimen described and figured, U.S.N.M. No. 535529, a cotype received from Gundlach, comes from Dos Cecillas, near Coliseo, Matanzas Province. It has almost 4 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 4.9 mm.; lesser diameter, 4.3 mm.

Gundlach states (Malak. Blätter, vol. 4, p. 42, 1857) that the "animal is whitish, head and neck with reddish sheen. Tips of tentacles somewhat greyish."

The species appears to range through the many limestone hills surrounding the region of Coliseo.

TORRELLA (TORRELLA) IMMERSA ([Gundlach] Pfeiffer)

Shell elongate-conic, flesh colored, with or without a brownish tinge. Nuclear whorls 2, inflated, well rounded, microscopically granulose, forming a mammillated apex. Postnuclear whorls strongly inflated, strongly rounded, marked by slender, low, lamellar, hollow axial ribs, which are slightly retractively curved. These ribs are feebly expanded into auricles at the summit. The spiral sculpture consists of feeble threads. Suture very strongly constricted, rendered all the more conspicuous because of the feeble development of the auricles at the summit of the ribs. Periphery strongly rounded. Base short, inflated, broadly umbilicated, well rounded, marked by the continuation of the axial ribs and by rather feeble spiral threads. Last whorl solute for about one-third of a turn. Aperture broadly oval; peristome double, the inner moderately exerted; the outer only

moderately broadly expanded, slightly reflected, and feebly digitated at the outer margin, marked by concentric lines of growth. The operculum is typically torrellid; it has the center depressed, this depression being responsible for the specific name. The breathing siphon begins immediately behind the peristome at the posterior angle of the aperture and it is reflected as a tapering corrugated tube into the umbilicus, which it completely plugs.

The species ranges through northeastern Habana and northwestern Matanzas Provinces. We are recognizing three subspecies, which the following key defines:

KEY TO THE SUBSPECIES OF TORRELLA (TORRELLA) IMMERSA

Fluting of outer peristome rather strong.

Axial ribs gathered into series at the summit..... *camaronensis*

Axial ribs not gathered into series at the summit..... *immersa*

Fluting of outer peristome not strong..... *grillensis*

TORRELLA (TORRELLA) IMMERSA CAMARONENSIS, new subspecies

PLATE 10, FIGURE 3

This race comes from various places in the Sierra Camarones, Matanzas Province. It differs from typical *T. (T.) immersa immersa* in having the axial ribs much more strongly developed at the summit and gathered into series; that is, stronger ribs are separated by narrow spaces occupied by less strongly developed elements. It agrees with *T. (T.) immersa immersa* in having the outer peristome rather strongly fluted, in which respect it differs from *T. (T.) immersa grillensis*.

The type, U.S.N.M. No. 535532, comes from Vista Larga farm, 2 km. west of La Peña del Leon, Sierra de Camarones. It has 4.4 whorls remaining, which bear, respectively, 74 axial ribs on the first whorl, 85 on the second, 110 on the third, and 112 on the last. It measures: Length, 8.8 mm.; greater diameter, 4.5 mm.; lesser diameter, 4.0 mm.

TORRELLA (TORRELLA) IMMERSA IMMERSA ([Gundlach] Pfeiffer)

PLATE 10, FIGURE 2

1857. *Cyclostoma immersum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 4, p. 42.

1858. *Ctenopoma immersum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 104.

1920. *Torrella (Torrella) immersa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

This subspecies was first described by Gundlach from Loma de Simpson, which is at the entrance to the Yumuri Valley. We have it also from the Yumuri Valley, Vista Alegre, and from Pan y Palenque, and

near Ceiba Mocha. This subspecies, like *T. (T.) immersa camaronensis*, has the outer peristome rather strongly fluted, but it differs from *camaronensis* in having the axial ribs not gathered into series.

The specimen described and figured, U.S.N.M. No. 535534, was collected at the type locality. It has a little more than 4 whorls remaining, of which the first has 51 axial ribs, the second 88, the third 90, and the fourth 86. It measures: Length, 9.2 mm.; greater diameter, 4.3 mm.; lesser diameter, 4.0 mm.

TORRELLA (TORRELLA) IMMERSA GRILLENSIS, new subspecies

PLATE 10, FIGURE 5

We have seen this subspecies from Madruga, Finca El Inglés, Sierra del Grillo, and from Sabana de Robles. It is easily distinguished from the other two subspecies by having the fluting of the outer peristome almost absent.

The type, U.S.N.M. No. 355623, comes from Madruga. It has 4.2 whorls remaining, which bear, respectively, 102 axial ribs on the first whorl, 126 on the second, and 130 on the last. It measures: Length, 8.2 mm.; greater diameter, 4.3 mm.; lesser diameter, 3.7 mm.

Subgenus TORRELLISCA Henderson and Bartsch

1920. *Torrellisca* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 69-70.

Shell elongate-conic, marked only by slender sublamellar axial riblets on the spire. Umbilicus marked by weak spiral cords. Peristome expanded but not fimbriated. Breathing siphon a simple tube but slightly bent, opening on the outside. Operculum typically torrellid.

Type: *Torrella (Torrellisca) simpsoni* Henderson and Bartsch.

KEY TO THE SPECIES OF THE SUBGENUS TORRELLISCA

Inner lip of outer peristome very broadly expanded..... *trinidadensis*
 Inner lip of outer peristome not very broadly expanded..... *simpsoni*

TORRELLA (TORRELLISCA) SIMPSONI Henderson and Bartsch

Shell elongate-conic, white. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly inflated, well rounded, marked by strongly raised, lamellar, rather distantly spaced axial riblets, which become slightly expanded at the summit into slender auricles. The spiral sculpture consists of obsolete threads, which at the most render the riblets slightly wavy. Suture strongly constricted. Periphery well rounded. Base short, well rounded, openly, narrowly umbilicated, marked by the continuation of the axial riblets and by spiral threads, the latter much stronger than those on the spire.

Last whorl solute for almost half a turn. Aperture very broadly oval; peristome double, the inner slightly exserted; the outer rendered irregular at the posterior angle by the breathing siphon, narrowly expanded, usually fluted at the junction of the inner and basal lip, and marked by concentric laminae. Operculum typical of *Torrella*. The breathing siphon consists of a curved, short tube, which has its origin immediately behind the peristome at the posterior angle of the aperture, and which is open at the inbent terminal.

This species appears to be confined to Santa Clara Province, where two subspecies are present. These can be distinguished readily by the following key and descriptions:

KEY TO THE SUBSPECIES OF *TORRELLA* (*TORRELLISCA*) *SIMPSONI*

Axial ribs distantly spaced..... *terneroensis*
 Axial ribs not distantly spaced..... *simpsoni*

TORRELLA (*TORRELLISCA*) *SIMPSONI* *TERNEROENSIS*, new subspecies

PLATE 10, FIGURE 7

This race was collected by Henderson at Loma del Ternero, 6 or 8 miles north of Manicaragua, Santa Clara Province. He collected it also at Hoyo de Manicaragua. It is distinguished readily from typical *T. (T.) simpsoni simpsoni* by having the axial ribs much more distantly spaced.

The type, U.S.N.M. No. 355540, has 3.8 whorls remaining, of which the first and second have 32 and the last 43 axial ribs. It measures: Length, 6.5 mm.; greater diameter, 3.5 mm.; lesser diameter, 3.0 mm.

TORRELLA (*TORRELLISCA*) *SIMPSONI SIMPSONI* Henderson and Bartsch

PLATE 10, FIGURE 6

1920. *Torrella (Torrellisca) simpsoni* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 80-81.

This subspecies comes from the Soledad plantation, near Cienfuegos, Santa Clara Province. It is distinguished readily from *T. (T.) simpsoni terneroensis* by the fact that the axial ribs are much more closely spaced.

The type, U.S.N.M. No. 314942, has a little more than 4 whorls remaining, of which the first bears 46 axial riblets, the second 60, the third 82, and the last 100. The type measures: Length, 7.4 mm.; greater diameter, 3.7 mm.; lesser diameter, 3.3 mm.

TORRELLA (*TORRELLISCA*) *TRINIDADENSIS*, new species

PLATE 10, FIGURE 8

Shell elongate-conic, flesh colored. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded and crossed

by lamellar axial riblets, which vary materially in strength; usually a group of several weak elements is succeeded by a strong one. The stronger ribs become expanded at the summit into auricles. The axial riblets are decidedly wavy, which would indicate spiral threads, but these are not apparent in the intercostal spaces. Of these ribs 36 occur on the first whorl, 48 on the second, 83 on the third, and 96 on the last. Suture strongly constricted. Periphery strongly rounded. Base moderately long, strongly rounded, marked by the continuation of the axial ribs, and within the umbilicus by spiral cords, which render the axial ribs decidedly scalloped at their junctions. The base is narrowly, openly umbilicated. The last whorl is solute for about one-tenth of a turn. Aperture subcircular; peristome double, the inner very slightly exerted; the outer very broadly expanded on the parietal and inner lip, less so on the outer lip and narrowest on the basal lip, marked by concentric lamellae. Operculum typically torrellid. The siphon is at the posterior angle of the aperture, short, and flexed into the suture, where it is marked by a series of rings.

The type, U.S.N.M. No. 535536, comes from Magua, Trinidad, Santa Clara Province. It has 4.1 whorls remaining and measures: Length, 7.0 mm.; greater diameter, 3.6 mm.; lesser diameter, 3.3 mm.

This species is readily distinguished from *T. (T.) simpsoni* by the broadly expanded inner lip of the outer peristome.

Genus RHYTIDOPOMA Sykes

1901. *Rhytidopoma* SYKES, Journ. Malac., vol. 8, p. 60.

Shell elongate-conic, axial riblets and spiral threads present in all the known species; the axial sculpture is usually stronger than the spiral. A recurved breathing siphon is present a little behind the peristome at the junction of the parietal and the outer wall. Operculum with the ribs not completely covering the whorls, thus showing the basal chondroid plate in a narrow sinus, which marks the outer edge of the turns. Both the inner and outer ends of the retractively curved ribs are fused into lamellae, which are considerably higher than the ribs, which extend in a gentle, retractive curve between the lamellae.

Type: *Rhytidopoma rugulosum* (Pfeiffer).

KEY TO THE SPECIES OF THE GENUS RHYTIDOPOMA

Umbilicus closed by the reflected peristome.....	honestum
Umbilicus not closed by the reflected peristome.	
Last whorl adnate.	
Outer peristome fluted.....	coronatum
Outer peristome not fluted.....	nodulatum

Last whorl solute.

Outer peristome expanded.

Outer peristome of inner lip very broad.

Axial ribs sublamellar.

Whorls decidedly inflated..... *occidentale*

Whorls not decidedly inflated..... *rugulosum*

Axial ribs not sublamellar..... *wrightianum*

Outer peristome of inner lip not very broad.

Outer peristome fluted..... *pinense*

Outer peristome not fluted..... *clathratum*

Outer peristome very narrow..... *hespericum*

RHYTIDOPOMA HONESTUM (Poey)

Shell elongate-conic, white. Nuclear whorls 2, large, strongly inflated and rounded, microscopically granulose, forming a mammillated apex. Postnuclear whorls well rounded, marked by slender, retractively curved axial ribs, which are expanded into hollow auricles at the summit and which are appressed to the preceding turn. The spiral sculpture is very poorly developed. Suture strongly constricted. Periphery well rounded. Base well rounded, marked by the continuation of the axial ribs and usually by strong spiral threads. Aperture broadly oval; peristome double, the inner slightly exserted, the outer moderately expanded, marked by concentric lines of growth, notched on the middle of the inner lip, the part posterior to the notch reflected over the umbilicus, which it covers. Operculum typically rhytidopomid. The breathing siphon is close to the posterior angle of the aperture behind the peristome, which it renders irregular at this point; it is reflected backward into the suture.

This species appears restricted to Habana Province. We are recognizing three subspecies:

KEY TO THE SUBSPECIES OF RHYTIDOPOMA HONESTUM

Axial ribs rather strong..... *itinerans*

Axial ribs weak.

Axial ribs closely spaced..... *honestum*

Axial ribs not closely spaced..... *nodiferum*

RHYTIDOPOMA HONESTUM ITINERANS, new subspecies

PLATE 10, FIGURE 10

This subspecies we collected along stone fences near Guanajay. It differs from the other two subspecies in having the axial ribs much more strongly developed.

The type, U.S.N.M. No. 493413, has 40 axial ribs on the first of the remaining turns and 50 on the last whorl; it has 3.7 whorls remaining and measures: Length, 7.8 mm.; greater diameter, 4.0 mm.; lesser diameter, 3.2 mm.

RHYTIDOPOMA HONESTUM HONESTUM (Poey)**PLATE 10, FIGURE 13**

1851. *Cyclostoma honestum* POEY, *Memorias sobre la historia natural de la isla de Cuba*, vol. 1, p. 103, pl. 7, figs. 1-4.
1856. *Ctenopoma honestum* PFEIFFER, *Malakozool. Blätter*, vol. 3, p. 126.
1920. *Rhytidopoma honestum* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 69.

This subspecies ranges from Habana to Lomas de Camoa, in Habana Province. It is distinguished from the others in being larger, with the ribs more closely spaced.

The specimen figured, U.S.N.M. No. 57312, was received from Arango. It has 52 axial ribs on the first of the remaining turns and 180 on the last; it has a little more than 4 whorls remaining and measures: Length, 9.4 mm.; greater diameter, 4.8 mm.; lesser diameter, 4.0 mm.

Of the animal of this species Gundlach states: "Animal pale, the sides with a violet sheen; antennae pale orange colored; eyes very black."

RHYTIDOPOMA HONESTUM NODIFERUM (Arango)**PLATE 10, FIGURE 11**

1881. *Ctenopoma nodiferum* ARANGO, *Proc. Acad. Nat. Sci. Philadelphia*, p. 16.
1920. *Rhytidopoma nodiferum* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 69.

This subspecies was described by Arango from Santo Cristo de la Salud, Habana Province. We have also seen it from Managua and Bejucal, Habana Province. It is smaller than the typical race, with the axial ribs much more distantly spaced, but weakly developed as in the typical form.

The specimen figured, U.S.N.M. No. 355567, was received by Dr. de la Torre from Arango. It has 60 axial ribs on the first of the remaining turns and 86 on the last; it has a little more than 3 whorls remaining and measures: Length, 6.7 mm.; greater diameter, 3.8 mm.; lesser diameter, 3.1 mm.

RHYTIDOPOMA CORONATUM ([Poey] Pfeiffer)**PLATE 10, FIGURE 14**

1856. *Ctenopoma coronatum* [Poey] PFEIFFER, *Malakozool. Blätter*, vol. 3, pp. 59, 126.
1857. *Ctenopoma coronatum* PFEIFFER, *Novitates conchologicae*, vol. 1, p. 96, pl. 26, figs. 17-19.
1858. *Cyclostoma coronatum* POEY, *Memorias sobre la historia natural de la isla de Cuba*, vol. 2, pp. 5, 24, pl. 1, figs. 11, 12.
1920. *Rhytidopoma coronatum* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 69.

Shell elongate-conic, white. Nuclear whorls decollated. Post-nuclear whorls inflated, well rounded, marked by slightly retractively curved, lamellar, wavy, hollow axial riblets, which are developed into auricles at the summit and into projections that are slightly less pronounced at the periphery. Of these riblets 78 occur upon the first, 104 upon the second, and 108 upon the last of the remaining turns. The spiral sculpture is obsolete on the spire, or it is at least only indicated by the waviness of the axial riblets. Suture strongly constricted. Periphery well rounded. Base short, inflated, well rounded, narrowly, apparently openly umbilicated, although the umbilicus is partly hidden by the reflected outer peristome, marked by the continuation of the axial riblets and 5 moderately strong threads slightly posterior to the umbilical angle. The thread bordering the umbilicus is much stronger than the rest and causes the riblets to expand at that point into strongly raised, clawlike elements; within the umbilicus additional spiral cords also forming scallops are present. These, however, are too much hidden to reveal their actual number. Aperture almost subcircular; peristome double, the outer broadly expanded, more so on the parietal and the inner lip than on the basal and the outer lip, decidedly fluted at the edge and marked by concentric lines of growth; on the parietal wall it becomes attached to the preceding turn; inner peristome slightly exerted. Operculum typically rhytidopomid. The last whorl is adnate. The breathing siphon originates at the posterior angle immediately behind the peristome and is wedged into a chink formed between the preceding turn and the parietal wall, but it does not extend into or plug the umbilicus.

The specimen figured, U.S.N.M. No. 355542, is a cotype collected by Poey at Managua, Potrero Almirante, Habana Province. It has a little over 3 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 4.3 mm.; lesser diameter, 3.6 mm.

Of this Gundlach says (*Malakozool. Blätter*, vol. 3, p. 126, 1856): "Animal whitish, particularly on the foot. Head and neck suffused with clay yellow. Antennae almost translucent. The region between the antennae, the neck and about the operculum greyish in the extended animal. Animal within the shell clay-yellowish white, brownish at the tip. It covers the shell almost horizontally and moves with alternating wave motion."

RHYTIDOPOMA NODULATUM (Poey)

Shell elongate-conic, flesh colored or pale yellowish. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a very large mammillated apex, which projects conspicuously beyond the outline of the rest of the spire. Postnuclear whorls inflated or at least moderately rounded, marked by retractively slanting axial ribs, which vary considerably in strength and elevation. The axial ribs

are not all of the same strength; that is, some of them are more elevated than others. Some of these ribs develop conspicuous auricles at the summit, which are usually hollow. The spiral sculpture is poorly developed and is merely indicated by the waviness of the axial riblets in some of the forms, while in others it is more strongly developed. Suture strongly constricted. Periphery well rounded. Base short, inflated, well rounded, narrowly umbilicated, the umbilicus usually hidden by the reflected inner peristome of the parietal wall. The base is marked by the continuation of the axial riblets and spiral threads, which vary in strength and number in the different races. Aperture broadly oval; peristome double, the inner slightly exserted; the outer broadly expanded, usually more so on the parietal and the inner lip than on the outer, and marked by concentric lines of growth; the inner peristome is slightly exserted. Operculum typically rhytidopomid. The breathing siphon begins behind the edge of the posterior angle of the aperture and is reflected backward into the suture.

This species ranges over Habana and Matanzas Provinces and breaks up into several races, which the following key and descriptions will help to distinguish:

KEY TO THE SUBSPECIES OF RHYTIDOPOMA NODULATUM

Outer peristome fluted on the posterior inner lip.....	palenquense
Outer peristome not fluted on the posterior inner lip.	
Whorls inflated and strongly rounded.....	nodulatum
Whorls not inflated or strongly rounded.....	anafense

RHYTIDOPOMA NODULATUM PALENQUENSE, new subspecies

PLATE 10, FIGURE 15

This subspecies centers about Matanzas, El Pan, El Palenque, the Yumuri Valley, etc. It can be distinguished readily from the other two races in that the outer peristome of the inner lip is fluted.

The type, U.S.N.M. No. 355548, comes from El Palenque. It has 46 axial ribs on the first of the remaining turns, 70 on the second, 96 on the third, and 112 upon the last. It has a little more than 4 whorls remaining and measures: Length, 7.9 mm.; greater diameter, 3.8 mm.; lesser diameter, 3.3 mm.

RHYTIDOPOMA NODULATUM NODULATUM (Poey)

PLATE 10, FIGURE 12

1851. *Cyclostoma nodulatum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, pl. 5, figs. 21-23.
1852. *Cyclostoma nodulatum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, p. 104.
1858. *Ctenopoma rugulosum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 103, in part.
1920. *Rhytidopoma nodulatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

This race occupies the limestone blocks south of Habana, in Habana Province. We have seen it from Cueva de Cotilla, Lomas de Candela, Loma de Coca, San José de las Lajas; Tetas de Managua, Tapaste; Mendoza, Sitio de Bonilla and Sitio Perdido, near Jaruco; San Antonio de los Baños; and Bacuranao and Guanabo east of Cojimar; all in Habana Province. This subspecies differs from *R. nodulatum palenquense* in lacking the fluting of the inner lip. It differs from *R. nodulatum anafense* in having the whorls much more inflated and more rounded, and in having the axial ribs less strong.

The specimen figured, U.S.N.M. No. 355561, comes from Tetas de Managua, Habana Province. It has 78 axial ribs on all the turns. It has 3.5 whorls remaining and measures: Length, 7.3 mm.; greater diameter, 4.0 mm.; lesser diameter, 3.3 mm.

RHYTIDOPOMA NODULATUM ANAFENSE, new subspecies

PLATE 10, FIGURE 9

This race comes from the Sierra de Anafe, Habana Province. We have also taken it at Guanajay, Pinar del Río Province, and Cayajabos, Finca de Francisco Martinez, Pinar del Río Province. It differs from the typical race in having the whorls larger but less inflated and less rounded, and in having the axial sculpture stronger.

The type, U.S.N.M. No. 355559, has 49 axial ribs on the first of the remaining whorls and 72 on the last turn; it has 3.2 whorls remaining and measures: Length, 7.5 mm.; greater diameter, 4.1 mm.; lesser diameter, 3.5 mm.

RHYTIDOPOMA OCCIDENTALE, new species

PLATE 10, FIGURE 16

1878. *Ctenopoma rugulosum* ARANGO, Contribucion a la fauna malacologica Cubana, pp. 15-16, in part.

1890. *Ctenopoma rugulosum* CROSSE, Journ. Conchyl., vol. 38, p. 276, in part.

Shell broadly elongate-conic, flesh colored; the plug at the decollated end shines through the substance of the shell as a reddish line. Nuclear whorls about 2, forming a slightly mammillated apex, strongly rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls slightly inflated, well rounded, marked by rather distantly spaced, slightly retractorily slanting axial riblets which become irregularly expanded at the summit. In the type 62 of these riblets occur upon the first turn, 88 upon the second, and 93 upon the last. The spiral sculpture is obsolete on the spire, only the merest indication of it being present. Suture strongly constricted. Periphery well rounded. Base short, inflated, well rounded, and marked by the continuation of the axial riblets and by 11 feeble spiral threads on the

base and in the umbilicus. Last whorl solute for about half a turn. Aperture broadly ovate; peristome double, the inner moderately well exerted and slightly reflected; the outer broadly, flaringly expanded, somewhat wavy, marked by concentric, feeble lamellae. Operculum typically rhytidopomid. The breathing siphon begins immediately behind the peristome at the posterior angle of the aperture and is reflected as a tapering tube into the umbilicus, which it plugs; the outside of the breathing siphon is marked by strong, coarse spiral rings.

The type, U.S.N.M. No. 355604, was collected near the lighthouse at the entrance to Cabañas Port, on the *Tomas Barrera* Expedition. It has a little over 3 whorls remaining and measures: Length, 8.2 mm.; greater diameter, 4.5 mm.; lesser diameter, 3.8 mm.

RHYTIDOPOMA RUGULOSUM (Pfeiffer)

PLATE 11, FIGURE 8

1839. *Cyclostoma rugulosum* PFEIFFER, Wieg. Archiv Naturg., vol. 1, p. 356.
1849. *Cyclostoma rugulosum* PFEIFFER, Martini-Chernitz Conchylien Cabinet, ed. 2, t. 14, p. 117, figs. 9-11; t. 38, figs. 11-12.
1858. *Ctenopoma rugulosum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 103 in part.
1920. *Rhytidopoma rugulosum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

Shell elongate-conic, pale yellow. Nuclear whorls 2, moderately inflated, well rounded, microscopically granulose, forming a mammillated apex. Postnuclear whorls moderately strongly rounded, marked by slender, sublamellar, retractively slanting, axial riblets, which are rendered slightly scalloped by obsolete spiral threads, of which 4 are present between the summit and the periphery. The axial riblets are slightly expanded at the summit. At more or less regular intervals several finer axial threads occur, separating groups of the stronger lamellae, which give the sculpture a somewhat interrupted pattern. Of the axial ribs 51 occur on the first of the remaining turns and 96 on the last. Suture strongly constricted. Periphery well rounded. Base rather short, well rounded, marked by the continuation of the axial ribs, which extend into the umbilicus, and by a few obsolete spiral threads; edge of the umbilicus marked by a strong spiral ridge, which renders the axial ribs decidedly scalloped; there is another ridge, which is a little less strong, just within the umbilicus. The last whorl is decidedly solute and deflected. Aperture very broadly oval, almost subcircular; peristome double, the inner slightly exerted, the outer broadly expanded and turned up at the junction of the inner and basal lip, marked by concentric laminae, which are a little narrower on the parietal wall than on the rest. Operculum typically

rhytidopomid. The siphon starts immediately behind the peristome at the posterior angle of the aperture and it extends as a tapering tube into the umbilicus, plugging the hollow axis; it is marked by concentric ridges.

The specimen described and figured, U.S.N.M. No. 386615, is one of a large series collected by Bartsch on the shore of Canimar River at the type locality, Fundador, Matanzas Province. It has 4.2 whorls remaining and measures: Length, 8.4 mm.; greater diameter, 3.8 mm.; lesser diameter, 3.5 mm.

We have it also from the Yumurí Valley at Matanzas.

RHYTIDOPOMA WRIGHTIANUM ([Gundlach] Arango)

Shell broadly elongate-conic, flesh colored. Nuclear whorls about 2, forming a somewhat mammillated apex, the whorls of which are strongly rounded and microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by lamellar or sublamellar axial riblets, which vary conspicuously in spacing and strength in the different races. These ribs are strongly expanded at the summit, where they frequently form conspicuous auricles, which, when broken, prove to be hollow. The spiral sculpture is very variable, ranging from obsolete to strongly lirate. Suture strongly constricted. Periphery well rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and by feeble or rather strong spiral threads, depending again upon the race in question. The last whorl is always solute for about half a turn and is strongly deflected. Aperture broadly oval; peristome double, the inner moderately exerted and scarcely reflected; the outer expanded, the amount of expansion varying in the different subspecies. The breathing siphon has its beginning at the posterior angle behind the peristome, tapering and reflecting into the umbilicus, which it completely plugs; the breathing, therefore, when the operculum is closed, is effected through the pore marking the hollow axis of the shell at the decollated end. Operculum typically rhytidopomid.

This species ranges from Cape San Antonio at the western end of Pinar del Rio Province, eastward to Cayajabos, breaking up into a number of subspecies, which may be distinguished by the following key and descriptions:

KEY TO THE SUBSPECIES OF RHYTIDOPOMA WRIGHTIANUM

Outer peristome broadly expanded.....	wrightianum
Outer peristome not broadly expanded.	
Outer peristome moderately expanded.....	ottonis
Outer peristome very narrow.....	cabrasense

RHYTIDOPOMA WRIGHTIANUM WRIGHTIANUM ((Gundlach) Arango)

PLATE 11, FIGURE 1

1881. *Ctenopoma wrightianum* (Gundlach) ARANGO, Proc. Acad. Nat. Sci. Philadelphia, p. 16.

Typical *wrightianum* was described from La Jaula, Pinar del Rio Province. We have seen it also from Cape Cajón and Cape San Antonio, and Valle de San Juan, Guanacabibes, Pinar del Rio Province. Its broadly expanded peristome will readily distinguish it from the other two races.

The specimen figured, U.S.N.M. No. 11045, a cotype, was collected by Wright at La Jaula. It has 85 axial ribs on the first of the remaining turns and 86 on the last whorl; it has 3.8 whorls remaining and measures: Length, 10.7 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.8 mm.

RHYTIDOPOMA WRIGHTIANUM OTTONIS, new subspecies

PLATE 11, FIGURE 5

This subspecies comes from the general region of Cayajabos, Pinar del Rio Province. We have representatives from the type locality, Mogote la Tumba and Charco Azul. This subspecies is distinguished readily from typical *R. wrightianum wrightianum* by its much narrower outer peristome, in which respect it stands halfway between the typical subspecies and *R. wrightianum cabrasense*.

The type, U.S.N.M. No. 493414, was collected by Bartsch on Mogote la Tumba. It has 68 axial ribs on the first of the remaining turns and 92 on the last. It has 3.4 whorls remaining and measures: Length, 8.1 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.2 mm.

RHYTIDOPOMA WRIGHTIANUM CABRASENSE, new subspecies

PLATE 11, FIGURE 4

This subspecies comes from the mogotes that occur around Kilometer 14 on the highway leading from Pinar del Rio to Luis Lazo, Pinar del Rio Province. It is readily distinguished from the other two subspecies by its extremely narrow outer peristome.

The type, U.S.N.M. No. 355609, comes from the Mogote del Cero de Cabras. On the first of the remaining turns it has 84 axial ribs, 114 on the second and 120 on the last. It has a little more than 4 whorls remaining and measures: Length, 8.9 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.4 mm.

RHYTIDOPOMA PINENSE, new species

Shell elongate-ovate, thin, flesh colored. Nuclear whorls 2, small, inflated, well rounded, microscopically granulose. Postnuclear whorls slightly inflated, rather strongly rounded and marked

by low, lamellar, somewhat wavy, retractively slanting axial ribs, which increase in numbers on succeeding turns. These ribs become broadly expanded at the summit, where they form auricles which, when broken, prove to be hollow. The spiral sculpture consists of poorly developed threads, which render the riblets slightly wavy. Suture strongly constricted. Periphery somewhat inflated, well rounded. Base slightly inflated, well rounded, and marked by the continuation of the axial ribs and by spiral threads; of the latter, those adjacent to the umbilicus and those on the umbilical wall are much stronger than those on the spire. The last whorl is solute for about half a turn and is decidedly deflected, showing the continuation of the axial riblets on the outside of the parietal wall. The siphon, which begins at the posterior angle a little behind the peristome, is deflected over the parietal wall and into the umbilicus, which it plugs completely. Aperture broadly oval, oblique; peristome double, the inner moderately strongly exerted and slightly reflected; the outer of almost the same width all around, marked by concentric lines of growth. Operculum rhytidopomid.

This species comes from the Isle of Pines and from the mainland of Cuba about Rosario, Ensenada de Cochinos. In the Isle of Pines it breaks up into several races that occupy the distinct limestone ranges. The following key and brief descriptions will help to differentiate them:

KEY TO THE SUBSPECIES OF RHYTIDOPOMA PINENSE

Shell large and stout.....	rosarioense
Shell not large or stout.	
Spiral umbilical cords few, strong.....	colombense
Spiral umbilical cords many and weak.	
Axial ribs closely spaced.....	ergastulum
Axial ribs not closely spaced.....	pinense

RHYTIDOPOMA PINENSE ROSARIOENSE, new subspecies

PLATE 11, FIGURE 14

This race comes from the south coast of Cuba, at Rosario, east side of Ensenada de Cochinos, Santa Clara Province. We do not consider the characters that distinguish it from the Isle of Pines forms sufficient to constitute specific separation. It is distinguished easily from the Isle of Pines forms, however, by its much larger size and stouter outline.

The type, U.S.N.M. No. 355583, has 78 axial ribs on the first of the remaining turns and 104 on the last; it has 3.7 whorls remaining and measures: Length, 12.2 mm.; greater diameter, 6.8 mm.; lesser diameter, 5.6 mm.

RHYTIDOPOMA PINENSE COLOMBENSE, new subspecies

PLATE 11, FIGURE 10

This race comes from the Sierra de Colombo. It is distinguished readily from the other subspecies in that the spiral cords in the umbilicus are few and much stronger than in the other races.

The type, U.S.N.M. No. 355579, has 88 axial ribs on the first of the remaining turns, 118 on the second, and 130 on the last; it has a little more than 4 whorls remaining and measures: Length, 10.3 mm.; greater diameter, 5.5 mm.; lesser diameter, 4.6 mm.

RHYTIDOPOMA PINENSE ERGASTULUM, new subspecies

PLATE 11, FIGURE 16

This race comes from the Presidio side of the Sierra de Caballos. The closely spaced axial ribs, combined with the weak spiral cords in the umbilicus, will differentiate this race from the others.

The type, U.S.N.M. No. 355581, has 82 axial riblets on the first of the remaining turns, 92 on the second, and 114 on the last whorl. It has 3.7 whorls remaining and measures: Length, 9.7 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.3 mm.

RHYTIDOPOMA PINENSE PINENSE, new subspecies

PLATE 11, FIGURE 17

This subspecies comes from the Sierra de Casas, where we collected it from one end of the range to the other. It is distinguished from *R. pinense colombense* in having many more spiral threads in the umbilicus and from *R. pinense ergastulum* in having the axial ribs stronger and more distantly spaced.

The type, U.S.N.M. No. 355576, was collected by Bartsch at the south end of the west side of the Sierra de Casas. There are 52 axial ribs on the first of the remaining turns and 84 on the last whorl; it has 4 whorls remaining and measures: Length, 11.3 mm.; greater diameter, 5.7 mm.; lesser diameter, 5.0 mm.

RHYTIDOPOMA CLATHEBATUM (Gould)

Shell elongate-conic, flesh colored. Nuclear whorls a little more than 2, inflated, well rounded, microscopically granulose, forming a mammillated apex, the last turn showing the beginning of the post-nuclear sculpture. Postnuclear whorls somewhat inflated, well rounded, marked by sublamellar or cordlike axial ribs. These ribs are much more strongly developed at the summit, where they are rather irregular and slightly retractorily slanting. In two of the subspecies, when the whorls are decollated they prove to be hollow and blisterlike. The spiral sculpture consists of obsolete threads, which render the axial ribs slightly wavy. Suture very strongly con-

stricted. Periphery strongly rounded. Base inflated, strongly rounded, marked by the continuation of the axial ribs and by feeble spiral threads, which vary somewhat in number in the different subspecies. Within the umbilicus spiral threads also are present. These are always stronger than those on the rest of the base. The last whorl is slightly solute for about half a turn and is broadly deflected. Aperture broadly ovate; peristome double, the inner moderately exerted and slightly reflected; the outer broadly expanded and reflected, not altogether in one plane but somewhat sinuous and marked on the outside by concentric feeble laminae. The operculum is typically rhytidopomid. The breathing siphon has its beginning a little behind the peristome at the posterior angle and is reflected from there as a slightly tapering tube, which completely plugs the umbilicus; this tube is slightly corrugated.

This species seems to occupy Habana, Matanzas, and Santa Clara Provinces. It breaks up into several subspecies, which can be differentiated by the following key and descriptions:

KEY TO THE SUBSPECIES OF RHYTIDOPOMA CLATHRATUM

Outer peristome of inner lip slightly fluted.....	<i>candelaense</i>
Outer peristome of inner lip not fluted.	
Shell slender.....	<i>jumaguaense</i>
Shell stout.....	<i>clathratum</i>

RHYTIDOPOMA CLATHRATUM CANDELAENSE, new subspecies

PLATE 11, FIGURE 2

This race comes from Loma de Candela and from Loma de Coca. It is distinguished easily from the other two races by having the inner lip of the outer peristome slightly fluted and by having the axial riblets much more strongly developed at the summit than in the other two. The spiral sculpture on the umbilicus is also stronger.

The type, U.S.N.M. No. 355607, comes from Loma de Candela. There are 100 axial riblets on the first of the remaining turns and 120 on the rest; it has 3.5 whorls remaining and measures: Length, 9.6 mm.; greater diameter, 5.3 mm.; lesser diameter, 4.6 mm.

RHYTIDOPOMA CLATHRATUM JUMAGUAENSE, new subspecies

PLATE 11, FIGURE 13

This subspecies is distinguished easily from the other two by its much slenderer form and by its less expanded outer peristome.

The type, U.S.N.M. No. 387502, was collected by Bartsch on the sixth mogote from the east at Jumagua near Sagua la Grande, Santa Clara Province. It has 57 axial ribs on the first of the remaining turns and 150 on the last whorl. It has 4.1 whorls remaining and measures: Length, 9.3 mm.; greater diameter, 4.9 mm.; lesser diameter, 4.4 mm.

RHYTIDOPOMA CLATHRATUM CLATHRATUM (Gould)

PLATE 11, FIGURE 15

1842. *Cyclostoma clathratum* GOULD, Boston Journ. Nat. Hist., vol. 4, cover to No. 1.
1856. *Ctenopoma clathratum* PFEIFFER, Malakozool. Blätter, vol. 3, p. 59.
1858. *Cyclostoma denegatum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, pp. 2, 23-24.
1920. *Rhytidopoma clathratum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 69.

This race occupies the region about Retiro, Coliseo, Bellamar, Matanzas, Calimete, and Cardenas; it was described from Retiro. We have selected a specimen from that locality for our figure. This race most nearly resembles *R. clathratum candelaense* but it is distinguished easily from *candelaense* by the much feebler development of the axial ribs at the summit, by the less strongly developed threads in the umbilicus, and by lacking the weak fluting of the inner lip of the outer peristome.

The specimen figured, U.S.N.M. No. 203630, has 80 axial ribs on the first of the remaining turns, 120 on the second, and 122 on the last. It has 3.8 whorls remaining and measures: Length, 10.6 mm.; greater diameter, 5.8 mm.; lesser diameter, 5.0 mm.

Gundlach says of the animal: "Nearly colorless or tinged with violet. Neck orange. Tentacles short, lemon colored."

RHYTIDOPOMA HESPERICUM, new species

PLATE 11, FIGURE 3

Shell very elongate-ovate, thin, translucent, horn colored with the plug showing through the substance of the shell as an oblique brown line. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly inflated, well rounded, and marked by very poorly developed, almost vertical axial riblets, of which 78 occur on the first whorl and 77 on the last turn. These riblets become thickened and hollow at the summit, but hardly form what might be termed cusps. The spiral sculpture consists of almost obsolete threads, which are scarcely indicated on the last whorl, while on the early whorls they render the axial riblets slightly nodulose. Suture very strongly constricted. Periphery strongly rounded. Base short, strongly rounded and marked by the feeble continuation of the axial riblets, with scarcely any indication of spiral threads on the umbilical wall. The last whorl is decidedly solute and strongly deflected. Aperture very broadly oval; peristome double, the inner decidedly exerted, almost straight; the outer projecting only a trifle beyond the inner, forming a mere ring about it. Operculum typically rhytidopomid. The siphon has its origin at the posterior angle of the aperture a little

distance behind the peristome, and it becomes attenuated and extends into the hollow axis of the shell, which it plugs.

The type, U.S.N.M. No. 493415, comes from Ceiba del Agua, Pinar del Rio Province. It has 3.3 whorls remaining and measures: Length, 9.6 mm.; greater diameter, 5.2 mm.; lesser diameter, 4.7 mm.

We have seen specimens of this species also from Artemisa.

This species is easily distinguished from the others by its narrower outer peristome and by the almost absent spiral sculpture in the umbilicus.

Genus *OPISTHOSIPHON* Dall

1905. *Opisthosiphon* DALL, Proc. Malac. Soc. London, vol. 6, p. 209.

The shell varies from broadly ovate through elongate-ovate to cylindro-conic. The nuclear whorls are microscopically granulose. The early postnuclear turns may be solute or appressed to the preceding whorl. Axial ribs are always present, varying in different groups from slender, hairlike elements to lamellae; their spacing varies widely in different groups. Fine microscopic axial threads may or may not be present between the heavier ribs. The spiral sculpture may consist of strong cords that may be present on all parts of the surface, or it may be restricted to the umbilicus. The last whorl may be solute or adnate to the preceding turn. The umbilicus presents a wide range of variance. It may be narrow or wide, open or closed. The aperture also presents considerable difference, varying from oval to subcircular, with the peristome always double; the inner peristome may be slightly or somewhat exserted; the outer peristome ranges from narrow to broadly expanded in different species and this expansion may extend over the entire lip or it may characterize only part of it. An auricle may or may not be present at the posterior angle. The operculum has the whorls separated by a narrow, deep groove, which on the last whorl constitutes the plain chondroid edge. The parts of the whorls between this inner edge and the groove are crossed by numerous, retractively curved, decidedly strongly raised lamellae separated by narrow spaces. Behind the aperture is the breathing siphon, upon which the generic name is based. This tube communicates by a puncture with the interior of the aperture near the posterior angle, slightly behind the edge of the peristome. The siphonal tube is usually directed upward and backward into the suture, though in a number of species with closed umbilicus the tube does not communicate at once with the free surface, but with a channel situated behind the broadly expanded, adnate parietal peristome of the outer lip, which in turn communicates with the hollow axis of the shell, and through this with the exterior through the decollated apex of the shell.

Type: *Opisthosiphon* (*Opisthosiphon*) *bahamense* Shuttleworth.

KEY TO THE SUBGENERA OF OPISTHOSIPHON

Spiral sculpture present.

Spiral sculpture present on spire, base, and umbilicus.

Fine axial threads present between the heavy ribs.

Early postnuclear whorls solute..... **Solutapex**

Early postnuclear whorls not solute..... **Mirisiphon**

Spiral sculpture absent on spire and base; present in umbilicus.

Axial ribs with individual cusps at the summit.

Fine axial threads present between the lamellar ribs

Bermudezsiphona

Fine axial threads absent between the lamellar ribs

Opisthosiphona

Axial ribs without individual cusps at the summit.

Axial ribs fused to form tufts at the summit..... **Cubitasiphona**

Spiral sculpture absent..... **Cylindrosiphona**

SOLUTAPEX, new subgenus

Shell ovate, with the early postnuclear whorls solute. The postnuclear whorls are marked by lamellar axial ribs and by spiral threads, which form hollow tubercles at their junctions. The axial ribs also become enlarged at the summit, where they form hollow cusps. The spaces between the axial ribs are marked by fine, microscopic axial threads. Operculum typically opisthosiphonid.

Type: *Opisthosiphon (Solutapex) caroli* Aguayo.

KEY TO THE SPECIES OF THE SUBGENUS SOLUTAPEX

Last whorl solute..... **sainzi**

Last whorl adnate.

Axial ribs closely spaced..... **quesadai**

Axial ribs distantly spaced.

Inner lip of outer peristome inbent in the middle..... **echinatum**

Inner lip of outer peristome not inbent in the middle..... **caroli**

OPISTHOSIPHON (SOLUTAPEX) SAINZI Aguayo

PLATE 11, FIGURE 7

1934. *Opisthosiphon sainzi* AGUAYO, Mem. Soc. Cubana Hist. Nat. Felipe Poey, vol. 8, p. 91, figs. 3, 4.

Shell small, elongate-ovate, pale brown, with the axial ribs a little paler. The last whorl also bears interrupted spiral bands of brown. Peristome flesh colored, aperture showing the reflection of the interrupted spiral bands within. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, and marked by sublamellar axial ribs, which are rendered decidedly wavy and somewhat scalloped by low, broad spiral bands. Of these axial ribs 58 are present on the last whorl. In addition to this sculpture, the spaces between the ribs, which are about two and one-half times as wide as the ribs, are marked by fine axial hairlines. Four of the low spiral cords are

present between the summit and suture. The suture is strongly constricted. Periphery strongly rounded. Base short, narrowly, openly umbilicated, well rounded, and marked by the continuations of the axial ribs and by 5 strong spiral cords, which grow consecutively stronger from the periphery toward the umbilicus. The junctions of the axial ribs and the spiral cords become increasingly more strongly scalloped from the periphery toward the umbilicus. The umbilical wall is marked by the continuation of the axial ribs and by feeble spiral cords. The last whorl is decidedly solute. Aperture broadly oval; peristome double, the inner slightly exerted; the outer moderately broadly expanded and marked by strong concentric lamellae. Operculum typically opisthosiphonid. The siphon is at the posterior angle of the aperture. It is expanded at its distal end, and it is marked by concentric ridges, opening toward the suture.

The paratypes before us were collected by Aguayo at Rejondón de Báguanos, Holguín, Oriente. The specimen figured, U.S.N.M. No. 425502, has 3.4 whorls remaining and measures: Length, 8.4 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.7 mm.

OPISTHOSIPHON (SOLUTAPEX) QUESADAI Aguayo

PLATE 11, FIGURE 11

1932. *Opisthosiphon quesadai* AGUAYO, Nautilus, vol. 45, pp. 95-96, pl. 6, fig. 5.

Shell rather large, elongate-ovate, pale wax yellow with interrupted spiral bands of brown. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a mammillated apex. The early postnuclear whorls are marked by rather distantly spaced axial ribs, which become increasingly more closely spaced as the shell increases in size. On the first whorl the ribs are about one-fourth as wide as the spaces that separate them, while on the last turn the ribs are only a trifle narrower than the intercostal spaces. On the early whorls, too, the ribs are much more lamellose than on the last, where they approach rounded cords. Of the axial ribs 150 are present on the last whorl. These axial ribs become expanded at the summit, where they form narrow, hollow cusps. They are also expanded on the middle whorls at the periphery, the two interlocking in this region. On the middle whorls the axial ribs are rendered somewhat scalloped by the 5 low, rounded spiral cords. On the last whorl the scalloping is obsolete. In addition to the axial ribs the spaces between them show the fine axial hairlines characteristic of the group. Suture strongly constricted. Periphery well rounded. Base short, well rounded, openly umbilicated. The umbilicus shows the continuation of the axial sculpture and 7 strong spiral cords, of which the first is the strongest and it marks the edge of the umbilicus, the rest gradually becoming narrower. The junctions of these spiral cords

with the axial riblets render the riblets conspicuously scalloped. Aperture very broadly oval. Peristome double, the outer broadly expanded and adnate to the preceding turn at the parietal wall, a little wider on the parietal and inner wall than on the rest, forming a slight auricle at the posterior angle, and marked by a series of concentric lamellae; inner peristome slightly exserted. Operculum typically opisthosiphonid. The siphon is immediately behind the peristome, short and directed backward into the suture.

The specimen figured, U.S.N.M. No. 535348, is a paratype, which was collected by Quesada on Loma de la Calera, San Germán. It is a complete specimen having 6.2 whorls measuring: Length, 11.8 mm.; greater diameter, 6.6 mm.; lesser diameter, 5.3 mm.

OPISTHOSIPHON (SOLUTAPEX?) ECHINATUM ([Gundlach] Pfeiffer)

PLATE 11, FIGURE 6

1857. *Cyclostoma echinatum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 4, p. 176.

1858. *Clenopoma echinatum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 103.

1920. *Opisthosiphon (Opisthosiphon) echinatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68.

Shell elongate-conic, flesh colored, unicolor or faintly spirally banded; peristome flesh colored. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, appressed at the summit, marked by strong, lamellose, scalloped axial ribs, of which 24 occur upon the first of the remaining turns in the specimen described and figured, 32 upon the second, 36 upon the third, and 48 upon the last whorl. The spiral sculpture consists of feeble broad threads, which render the riblets scalloped. Of these spiral threads, 5 occur upon the first, 6 upon the second, 9 upon the third, and 10 upon the last whorl between the summit and the suture. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial riblets and by 5 spiral cords, which also render the ribs scalloped; within the umbilicus 6 or more additional scalloped cords are present. Aperture broadly oval; peristome double, the outer very strongly expanded, partly inbent on the inner lip to cover part of the umbilicus, marked by a series of concentric lamellae; outer peristome adnate to the preceding turn on the parietal wall, forming a conspicuous auricle at the posterior angle, behind which the breathing siphon is present; inner peristome exserted and slightly reflected. Operculum paucispiral with the nucleus halfway between subcentral and submarginal, marked by numerous, retractively slanting, strongly raised, calcareous lamellae, which are fused both on their inner and outer borders.

U.S.N.M. No. 493362 contains a cotype collected at Cabo Cruz by Gundlach and presented to the National Museum by Dr. de la Torre.

It has slightly more than 4 whorls and measures: Length, 9.6 mm.; greater diameter, 5.8 mm.; lesser diameter, 4.4 mm.

OPISTHOSIPHON (SOLUTAPEX) CAROLI Aguayo

PLATE 11, FIGURES 9, 12

1932. *Opisthosiphon caroli* AGUAYO, Nautilus, vol. 45, p. 94, pl. 6, figs. 2, 3.

1932. *Opisthosiphon rivorum* AGUAYO, Nautilus, vol. 45, p. 95, pl. 6, fig. 4.

Shell elongate-ovate. Nuclear whorls 2, inflated, strongly rounded, smooth, except for microscopic granules. The first 1.5 postnuclear whorls are decidedly solute, strongly rounded, showing the beginning of the sculpture characteristic of the later postnuclear turns. The postnuclear whorls are moderately rounded and they are crossed by slender, sublamellar axial ribs, of which 53 are present upon the last turn in the specimen figured. These axial ribs expand at the summit, where they form delicate hollow cusps, which project materially above the suture. The axial ribs are marked by slender tubercles having their long axis parallel with the axial sculpture; 4 of these are present between the summit and the suture. The spaces between the lamellar axial ribs are crossed by exceedingly fine, microscopic, closely spaced axial lirations. Suture moderately impressed. Periphery strongly rounded. Base short, well rounded, narrowly umbilicated, and marked by the continuation of the axial ribs and by 3 broad low spiral cords, which render the axial ribs scalloped. The umbilical wall is marked by the feeble continuation of the axial ribs and by 4 strong spiral series of cusps. Aperture broadly oval; peristome double, the outer broadly, flaringly expanded, a little wider at the posterior angle, where it forms a slight auricle, marked by a series of wavy, concentric lamellae; the inner is slightly exserted. There is a puncture on the parietal wall near the posterior angle of the aperture, which communicates with the short siphon; the siphon is reflected backward into the suture. Operculum typically opisthosiphonid.

The specimen figured, U.S.N.M. No. 535346, was collected by Dr. Aguayo in Loma de la Caridad, Calabazas, Holguín, Oriente Province. It has 3.5 whorls remaining and measures: Length, 9.3 mm.; greater diameter, 5.8 mm.; lesser diameter, 4.5 mm.

An examination of topotypes of *Opisthosiphon rivorum* Aguayo, received from Dr. Aguayo, shows that the early postnuclear whorls of this shell are also solute. A comparison of all the other characters in our estimation yields no data to render the two even subspecifically distinct. Their identity is also proclaimed by their habitat, since both species come from the same hill, separated by a distance of only about 2 kilometers.

MIRISIPHON, new subgenus

Shell cylindro-conic, marked by slender, rounded, closely spaced, axial ribs. Between these ribs fine microscopic axial threads are present. The spiral sculpture consists of slender threads, whose junctions with the axial ribs form fine nodules. Siphon a little behind the peristome, directed backward into the suture. Operculum typically opisthosiphonid.

Type: *Opisthosiphon (Mirisiphon) sculptum* ([Gundlach] Pfeiffer).

OPISTHOSIPHON (MIRISIPHON) SCULPTUM ([Gundlach] Pfeiffer)

PLATE 12, FIGURE 8

1857. *Cyclostoma sculptum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 4, pp. 176-77.
1858. *Ctenopoma sculptum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 103.
1920. *Opisthosiphon (Opisthosiphon) sculptum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68.

Shell elongate-conic, flesh colored with a yellowish tinge, marked by 3 broad spiral bands of brown between summit and suture, and a fourth a little anterior to the periphery. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by very regular and very regularly spaced, wavy and slightly retractively slanting axial riblets, of which 34 occur upon the first, 44 upon the second, 76 upon the third, and 104 upon the last turn. These riblets are distantly spaced on the early turns and become more closely approximated as the shell increases in size; almost every other one of these riblets develops into a small sharp cusp at the summit. The spiral sculpture consists of slender threads about equaling the riblets in strength. Of these, 4 are present on the first whorl, 5 on the second, 10 upon the third, and 12 upon the last. They render the axial sculpture slightly nodulose and slightly wavy. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, broadly, openly umbilicated, and marked by the continuation of the axial riblets and by 5 spiral threads; within the umbilicus 9 additional threads are present. Aperture oval; peristome double, the outer broadly expanded, of almost the same width all around, adnate to the preceding turn on the parietal wall; at the posterior angle it forms an auricle, which is appressed and attached to the breathing siphon immediately behind it; the inner peristome is slightly exerted and slightly reflected. Operculum typically opisthosiphonid.

The specimen described and figured, U.S.N.M. No. 493369, is one of four collected at Cabo Cruz, Oriente Province. It has a little over 4 whorls and measures: Length, 7.3 mm.; greater diameter, 4.2 mm.; lesser diameter, 3.3 mm.

Bartsch collected it also at the mouth of the Rio Ojo del Toro in Oriente Province.

BERMUDEZSIPHONA, new subgenus

In this subgenus the spiral sculpture is confined to the umbilicus. (Sometimes there is an indication of it on the early postnuclear whorls.) The intercostal spaces are marked by microscopic axial threads.

Type: *Opisthosiphon (Bermudezsiphona) bermudezi*, new species.

KEY TO THE SPECIES OF THE SUBGENUS BERMUDEZSIPHONA

Umbilicus closed.

- Outer peristome erect..... **cucullatum**
- Outer peristome not erect.
 - Outer peristome suberect..... **palmeri**
 - Outer peristome not suberect.
 - Outer peristome horizontally expanded.
 - Outer peristome broad.
 - Shell ovate..... **greenfieldi**
 - Shell elongate-ovate.
 - Axial ribs of last whorl strongly developed.
 - Basal peristome broadly expanded. **lamellosum**
 - Basal peristome only moderately expanded..... **plateroense**
 - Axial ribs of last whorl not strongly developed..... **prominulum**
 - Outer peristome narrow.
 - Shell ovate.
 - Axial ribs very closely spaced..... **banaoense**
 - Axial ribs not closely spaced..... **obturatorum**
 - Shell elongate-ovate..... **obtectum**
 - Shell not elongate-ovate.
 - Shell subcylindric..... **insulanum**

Umbilicus open.

- Last whorl decidedly solute.
 - Axial ribs sublamellar..... **salustii**
 - Axial ribs not sublamellar..... **evanidum**
- Last whorl not decidedly solute.
 - Last whorl subsolute..... **subobturatum**
 - Last whorl not subsolute.
 - Last whorl adnate to preceding turn.
 - Inner lip of outer peristome strongly notched or folded.
 - Axial ribs distantly spaced..... **torrei**
 - Axial ribs not distantly spaced.
 - Shell elongate-ovate..... **caguanense**
 - Shell ovate or pupoid..... **subobtectum**
 - Inner lip of outer peristome not notched or folded.
 - Shell elongate-ovate..... **aguilerianum**
 - Shell ovate or pupoid.
 - Axial ribs closely spaced..... **detectum**
 - Axial ribs distantly spaced..... **bermudezi**
 - Outer peristome narrow.
 - Outer peristome broad..... **andrewsi**

OPISTHOSIPHON (BERMUDEZSIPHONA) CUCULLATUM, new species**PLATE 12, FIGURE 7**

Shell elongate-ovate, pale yellow with faint interrupted spiral bands of brown. Nuclear whorls 1.5, small, inflated, strongly rounded, microscopically granulose, forming an almost cylindric, truncated apex. Postnuclear whorls well rounded, the first marked by slender, rather closely spaced, hairlike, decidedly retractively slanting axial ribs. On the succeeding turns these ribs become more distantly spaced and they develop into slender lamellae, which again become less highly elevated and more rounded toward the last whorl. On the early whorls these ribs are finely scalloped. On the later turns this sculpture disappears. On all the turns the ribs become expanded at the summit into narrow cusps, which extend across the suture to touch the preceding turn. Of these ribs 48 occur upon the last whorl in the type. The spaces separating the axial ribs are much wider than the ribs and are marked by slender, somewhat sinuous axial threads; they are free of spiral sculpture. The suture, while well impressed, is rendered less conspicuous by the cusps of the ribs at their summit. Periphery well rounded. Base short, marked by the continuation of the axial ribs and within the exposed portion of the umbilicus by 3 spiral threads, which render the axial ribs decidedly scalloped at their junction. Aperture broadly oval, almost subcircular; peristome double, the inner erect and slightly exserted, the outer broadly expanded, the expanded portion also erect or even inbent partly over the aperture, forming a decided hoodlike auricle at the posterior angle. On the inner lip the outer peristome is deeply notched and the portion posterior to the notch is reflected over the umbilicus, which it plugs; the plug appears decidedly pinched in. On the parietal wall the outer peristome is reflected over the preceding turn. The outer peristome is covered with slender, concentric laminae. The operculum is typically opisthosiphonid. The siphon is short and directed into the suture and communicates through the channel behind the parietal lip with the hollow axis of the shell, breathing being accomplished through the hollow axis and through the decollated apex when the operculum closes the aperture.

The type, U.S.N.M. No. 535433, has 4.8 whorls remaining and measures: Length, 10.4 mm.; greater diameter, 5.8 mm.; lesser diameter, 4.7 mm. A large series of specimens was collected by Bartsch on the north slope of the Sierra de Meneses, east of Yaguajay, Santa Clara Province.

Bartsch collected specimens also opposite Jungalito, on the north slope of the Sierra de Meneses, and Bermudez found it at Urbaza and El Yigre, Yaguajay.

The fact that the outer peristome is erect and forms a strong hood at the posterior angle of the aperture distinguishes this species from all the other *Opisthosiphons*.

Animals collected in the Sierra de Meneses opposite Kilometers 42 and 43 were described by Bartsch as follows: Pale buff with a smoky tinge and a pinkish area at the base of the dark gray tentacles. There is a median dorsal diffused longitudinal stripe. Sides of the body a little paler than the dorsal part, with the sole of the foot paler than the sides and deeply cleft. The animal at rest suspends itself by a mucous thread.

OPISTHOSIPHON (BERMUDEZSIPHONA) PALMERI, new species

Shell elongate-ovate, thin, small. Nuclear whorls decollated in all our specimens. The early postnuclear whorls with strongly raised, lamellar axial ribs, which beyond the second turn become decidedly reduced and which are replaced by ill-defined, low, rounded axial ribs. Some of the axial ribs develop into hollow cusps at the summit, which extend across the well-impressed suture and which touch the preceding whorl. Periphery well rounded. Base moderately long, marked by the continuation of the axial sculpture of the last turn and by a spiral thread, limiting the outer edge of the umbilicus, which renders the ribs decidedly scalloped. Aperture broadly oval; peristome double, the inner exerted and erect; the outer broadly expanded, sloping at an angle of 45° from the inner peristome, marked by numerous slender, concentric lamellae. On the inner lip the peristome is deeply notched, the portion posterior to the notch being reflected over the umbilicus, which it plugs. Operculum typically opisthosiphonid. The siphon is at the posterior angle of the aperture behind the peristome and it is directed backward into the suture, where it connects through a channel behind the parietal wall with the hollow axis, breathing being accomplished through the decollated tip.

This species is distinguished from *O. (B.) cucullatum* by its much less erect outer peristome and by the much enfeebled axial sculpture of the later turns.

We are recognizing two subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) PALMERI

Axial ribs of last whorls well developed.....	palmeri
Axial ribs of last whorls almost obsolete.....	camajanense

OPISTHOSIPHON (BERMUDEZSIPHONA) PALMERI PALMERI, new subspecies

PLATE 12, FIGURE 3

This subspecies is known from Guainabo, and Pie Valdes, near Yaguajay, Santa Clara Province. It differs from *O. (B.)*

palmeri camajanense in having the axial ribs well developed on the last whorl.

The type, U.S.N.M. No. 535436, was collected by Dr. Bermudez at Guainabo, Yaguajay. It has almost 4 whorls remaining and measures: Length, 13.4 mm.; greater diameter, 7.3, mm; lesser diameter, 6.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) PALMERI CAMAJANENSE, new subspecies

PLATE 12, FIGURE 1

This subspecies differs from typical *O. (B.) palmeri palmeri* in having the axial sculpture reduced to almost the vanishing point on the later turns, and in having the denticles at the summit much stronger. It was collected by Bermudez at Camaján, Yaguajay, Santa Clara Province.

The type, U.S.N.M. No. 535439, has 3.8 whorls remaining and measures: Length, 15.0 mm.; greater diameter, 8.2 mm.; lesser diameter, 6.8 mm.

This subspecies varies greatly in size, as does the typical species; the smallest specimen before us has 3.7 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 6.7 mm.; lesser diameter, 5.6 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) GREENFIELDI, new species

PLATE 12, FIGURE 11

Shell broadly ovate, ranging from flesh colored to pale yellow to chestnut-brown, unicolor, or with a parietal band of darker brown. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming an almost cylindric truncated apex. The initial part of the nuclear turns is brown, the rest white. Postnuclear whorls inflated, strongly rounded, marked by slightly retractorily slanting sublamellar axial ribs, which are more distantly spaced on the early turns than on the later whorls. At irregular intervals these ribs form hollow cusps at the summit. The spaces between the axial ribs are marked by microscopic axial threads. Of the axial ribs 86 are present on the last whorl in the type. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs, which extend undiminished to the umbilicus. The outside of the closed umbilicus is marked by 4 spiral cords, which render the axial ribs strongly scalloped at their junctions. Aperture broadly oval; peristome double, the inner slightly expanded, reflected and appressed to the outer; the outer broadly expanded, forming a decided auricle at the posterior angle, deeply notched on the middle of the inner lip. Posterior to the notch the outer peristome is reflected over the umbilicus, which it completely covers. It also extends as a broad flap adnate to the

preceding turn at the parietal wall. The entire outer peristome is marked by numerous slender, concentric lamellae, which are particularly emphasized at the posterior angle. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture, reflected backward and toward the suture behind the peristome, connecting with a channel behind the parietal peristome, communicating with the hollow axis of the spire, breathing being accomplished through this by means of the truncated apex when the operculum closes the shell.

The type, U.S.N.M. No. 535441, and a series of specimens were collected by Bartsch on rocks at Sitio Afuera, at the south end of the Paso de la Escalera, Cubitas Mountains, Camagüey Province.

The type has 4.5 whorls remaining and measures: Length, 14.7 mm.; greater diameter, 9.3 mm.; lesser diameter, 7.3, mm. It is a medium-sized specimen; in the collection there are larger and smaller individuals.

OPISTHOSIPHON (BERMUDEZSIPHONA) LAMELLOSUM, new species

Shell very elongate-ovate, flesh colored, unicolor or banded. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, and marked by retractively slanting, sublamellar axial ribs, which are much more distantly spaced on the early turns than on the last. These ribs form hollow cusps at the summit at more or less regular intervals; they vary materially in strength in the two races here recognized. The spaces separating the axial ribs are microscopic axial threads. Suture strongly constricted. Periphery of the last whorl strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs and immediately outside of the closed umbilicus by several spiral threads, which render the axial ribs conspicuously scalloped. Aperture broadly oval; peristome double, the inner moderately exerted; the outer broadly expanded, reflected, and auriculated at the posterior angle, and deeply notched on the inner lip, the portion posterior to the notch being reflected into the umbilicus, which it plugs. The outer peristome is marked by fine, concentric lamellae. Operculum typically opisthosiphonid. The siphon is situated at the posterior angle of the aperture behind the peristome; it is reflected into the suture and communicates through a channel behind the parietal wall with the hollow axis and the decollated apex.

We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) LAMELLOSUM

Shell with interrupted spiral bands of brown.....	lamellosum
Shell without interrupted spiral bands of brown.....	lowei

OPISTHOSIPHON (BERMUDEZSIPHONA) LAMELLOSUM LAMELLOSUM, new subspecies

PLATE 12, FIGURE 4

This race comes from Espinosa, Chambas, Camagüey Province. It differs from *O. (B.) lamellosum lowei* in being conspicuously banded with interrupted zones of brown. These markings extend to the outer peristome where the ribs are also much more distantly spaced and a little more strongly sublamellose than in the other subspecies. There is also a tendency toward a line of nodules on the ribs below the cusps at the summit, which gives a false aspect of having a spiral cord. This is not true of the other race. The type has 39 ribs on the last whorl.

The type, U.S.N.M. No. 535442, has 4.0 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 6.6 mm.; lesser diameter, 5.1 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) LAMELLOSUM LOWEI, new subspecies

PLATE 12, FIGURE 6

Bartsch collected this subspecies in various places in the Dos Sierras, Santa Clara Province. It differs from typical *O. (B.) lamellosum lamellosum* in being unicolor, therefore lacking the rays on the outer peristome; in being larger and a little more elongate with more inflated whorls; and in having the axial ribs much more closely spaced and more numerous, with less conspicuous cusps at the summit; 84 axial ribs are present on the last turn in the type.

The type, U.S.N.M. No. 535444, is a complete specimen having 6.4 whorls and measures: Length, 12.0 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.2 mm.

We have seen it also from Loma Esperanza, Zaza del Medio, Santa Clara Province.

OPISTHOSIPHON (BERMUDEZSIPHONA) PLATEROENSE, new species

PLATE 12, FIGURE 10

Shell elongate-ovate, thin, pale brown, with interrupted spiral bands of darker brown, of which 6 are present on the last turn between summit and suture, and 3 are on the posterior half of the base in the type. Peristome yellow. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming an almost cylindric truncated apex. Postnuclear whorls strongly inflated, rounded, and marked by distantly spaced, sublamellar, slightly retractively slanting axial ribs, which become expanded near the summit into slender cusps, which extend up on the preceding whorl. Not infrequently these cusps are hollow. In addition to this, the axial ribs bear slight scallops; these scallops give the shell a somewhat spirally sculptured

effect, which, however, is not apparent in the intercostal spaces. The broad spaces between the axial ribs are marked by microscopic axial threads. Suture strongly constricted. Periphery of the last whorl inflated, strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs, and on the exposed portion of the umbilicus by 3 prominent spiral cords, which render the axial ribs at their junction decidedly scalloped. Aperture broadly oval; peristome double, the inner rather conspicuously exerted; the outer broadly expanded, slightly auriculate at the posterior angle, and deeply notched on the middle of the inner lip, the portion posterior to the notch being reflected to plug the umbilicus. The outer peristome is marked by numerous, strongly developed, concentric lamellae. Operculum typically opisthosiphonid. The siphon at the posterior angle of the aperture, behind the peristome, is reflected into the suture and communicates with the channel behind the parietal wall, which is connected with the hollow axis and the decollated apex.

The type, U.S.N.M. No. 387920, has 4 whorls remaining and measures: Length, 13.0 mm.; greater diameter, 8.0 mm.; lesser diameter, 6.5 mm.

A large series of specimens was collected by Bartsch on the north slope of Loma Platero, near Jagüey, Santa Clara Province.

OPISTHOSIPHON (BERMUDEZSIPHONA) PROMINULUM, new species

PLATE 12, FIGURE 2

Shell very elongate-ovate, moderately thin, pale yellowish brown. Nuclear whorls decollated. Postnuclear whorls somewhat inflated, strongly rounded, and marked by retractively slanting ribs, which are more pronounced and more widely separated on the early turns than on the succeeding whorls. On the last two whorls they become decidedly reduced and they are here but slightly elevated. The spaces between the axial riblets are crossed by microscopic axial threads. Of the axial riblets 82 occur upon the last turn. Some of these axial riblets become expanded at the summit to form hollow cusps at more or less regular intervals. Suture well impressed. Periphery of the last whorl inflated, strongly rounded, and marked by the continuation of the weak axial ribs, which extend to the closed umbilicus. The exposed portion of the umbilicus shows 3 spiral cords, which render the axial riblets somewhat scalloped. Base short, well rounded. Aperture broadly oval, peristome double, the inner slightly exerted, the outer broadly expanded, forming an auricle at the posterior angle and being notched on the middle of the inner lip; the portion posterior to the notch is reflected to plug the umbilicus. On the parietal wall the outer lip extends over and is adnate to the

preceding turn. Operculum typically opisthosiphonid. The siphon at the posterior angle of the aperture behind the outer peristome is reflected into the suture, communicating with the channel behind the parietal wall, connecting with the hollow axis and the decollated tip.

The type, U.S.N.M. No. 535446, was collected by Bermudez at Cambao, Yaguajay, Santa Clara Province. It has 3.7 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 6.9 mm.; lesser diameter, 5.7 mm.

We have seen specimens also collected by Bermudez at Vereda del Resbalillo, Yaguajay and at Vereda El Guajaco, Cambao, Yaguajay, Santa Clara Province.

OPISTHOSIPHON (BERMUDEZSIPHONA) BANAENSE Torre and Henderson

Shell varying from ovate to broadly ovate and ranging in color from white to flesh color to pale yellow to orange and brown to unicolor or with a band of dark brown at the periphery. Nuclear whorls 2, small, inflated, strongly rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, and marked by numerous closely spaced, almost vertical axial ribs, which are stronger and more distantly spaced on the early turns than on the later. These ribs develop at more or less regular intervals into hollow cusps at the summit, which are also of varying size, suture well constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, and marked by the continuation of the axial ribs, which extend undiminished into the umbilicus. The exposed portion of the umbilicus shows several spiral threads, which render the axial riblets scalloped at their junctions. Aperture broadly ovate; peristome double, the inner moderately exerted on the inner lip and reflected over and appressed to the outer peristome of the outer lip. The outer peristome is narrowly expanded on the outer and basal lip, and broadly expanded to form an auricle at the posterior angle. On the inner lip the outer peristome is also expanded and deeply notched; the broad flap posterior to the notch is reflected over and plugs the umbilicus, while on the parietal wall it is adnate to the preceding turn. The outer peristome is marked by fine concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture bends into the suture, connecting with the hollow axis through a channel behind the outer peristome of the parietal wall.

This species appears to be confined to the southwestern portion of the Cubitas Mountain region. We are recognizing two subspecies, which the following key and descriptions will help to distinguish:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) BANAENSE

Shell broadly ovate.....	banaense
Shell ovate.....	trincherasense

OPISTHOSIPHON (BERMUDEZSIPHONA) BANAEOENSE BANAOENSE Torre and Henderson

PLATE 12, FIGURE 5

1921. *Opisthosiphon (Opisthosiphona) obturatum banaoense* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 253.

This subspecies was described from Banao off the southwestern part of the Cubitas Mountains, is shorter than *O. (B.) banaoense trincherasense*, and usually has the umbilicus more deeply plugged by the reflected inner lip of the outer peristome. The first remaining whorl in the type bears 72 riblets; 152 are present upon the last one.

The type, U.S.N.M. No. 314950, has a little over 3 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.4 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) BANAEOENSE TRINCHERASENSE, new subspecies

PLATE 12, FIGURE 9

1920. *Opisthosiphon (Opisthosiphona) trincherasensis* (Torre and Henderson MS. HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*).

This race was collected by Torre in the Paso de las Trincheras western end of the Cubitas Mountain. It is more elongate than the typical race and it is usually of darker color.

The type, U.S.N.M. No. 355473, has 3 whorls remaining and measures: Length, 14.0 mm.; greater diameter, 9.9 mm.; lesser diameter, 7.3 mm. It has 56 axial riblets on the first of the remaining turns and 142 upon the last whorl.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTURATUM Torre and Henderson

Shell ovate, varying from flesh color to horn color, buff to orange or even to brown. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls well rounded, and marked by retractively slanting, sublamellar axial ribs, the early ribs bearing slender elongated thickenings resembling nodules that would indicate spiral sculpture, which, however, is not present in the intercostal spaces. The slight spiral sculptured effect, therefore, is a false one. These ribs at irregular intervals become strongly developed at the summit, where they form hollow cusps, which extend up on the preceding turn and which are adnate to it. The spaces separating the axial ribs are much wider than the ribs. Suture well constricted. Periphery well rounded. Base moderately long, marked by the continuation of the axial ribs and several inconspicuous spiral threads on the exposed portion of the umbilical wall. Aperture broadly oval; peristome double, the inner slightly exerted and reflected, particularly so on the outer lip; the outer peristome is broadly ex-

panded at the posterior angle to form a conspicuous auricle. It is narrower on the outer and basal lip where it is again expanded on the inner lip, which is deeply notched. Posterior to the notch it forms a very broad flap, which extends over the umbilicus and covers it. The outer peristome is marked by conspicuous concentric lamellae. Operculum typically opisthosiphonid. The siphon is at the posterior angle of the aperture behind the peristome, directed into the suture, where it connects with the slender tube connecting with the umbilicus and, through the hollow axis, with the decollated end of the shell.

The species is restricted to the Cubitas Mountains. We are recognizing two subspecies from this locality, which the following key will help to distinguish:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) OBTURATUM

Whorls inflated.....	sulcosum
Whorls well rounded.....	obturatum

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTURATUM SULCOSUM, new subspecies

PLATE 13, FIGURE 12

This subspecies is more elongated than *O. (B.) obturatum obturatum*. It has the axial ribs on all the whorls much more distantly spaced. Of these, 18 are present on the first whorl and 51 are upon the last in the type. The ribs also show the nodules referred to in the specific description much more emphasized than in the other subspecies.

The type, U.S.N.M. No. 535450, was collected by Bartsch at Salto del Paso Tinaja, about 1.5 km. from the north entrance to the pass. It has 5.0 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 8.9 mm.; lesser diameter, 7.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTURATUM OBTURATUM Torre and Henderson

PLATE 13, FIGURE 11

1920. *Opisthosiphon (Opisthosiphona) obturatus* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.
 1921. *Opisthosiphon (Opisthosiphona) obturatum obturatum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 252, pl. 39, figs. 3-6.

This race, which comes from Paso de Lesca, Cubitas Mountains, is much more rotund than *O. (B.) o. sulcosum* and has broader whorls. The axial ribs are much more numerous, more closely spaced, and more conspicuously cusped at the summit. Of the axial ribs, 34 are present on the first of the remaining turns and 92 are upon the last in the type.

The type, U.S.N.M. No. 314948, has a little more than 4 whorls remaining and measures: Length, 14.5 mm.; greater diameter, 10.0 mm.; lesser diameter, 7.7 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM Torre and Henderson

Shell elongate-ovate, rather thin, horn colored, unicolor, or banded with interrupted spiral zones of brown. Nuclear whorls 2, small, inflated, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, and marked by slender, slightly retractively curved axial ribs, which are more distantly spaced on the early turns than on the later and which in some of the races become decidedly reduced on the last whorl. Some of these ribs develop into slender cusps at the summit at more or less regular intervals; these cusps are not infrequently hollow. The intercostal spaces are marked by microscopic axial threads. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs and, in the exposed portion of the umbilicus, by spiral threads. Aperture broadly oval almost subcircular, peristome double, the inner exerted and slightly reflected on the outer lip but free from the outer, which is narrowly expanded on the outer lip, a little more expanded on the inner, and which forms a moderately conspicuous auricle at the posterior angle. The outer peristome of the inner lip is deeply notched, and the portion posterior to the notch is reflected into the umbilicus, which it plugs. The outer peristome is marked by slender, concentric lamellae. The operculum is typically opisthosiphonid. The siphon, situated at the posterior angle of the aperture behind the peristome, connects with the channel behind the parietal portion of the outer peristome and in turn with the hollow axis and the decollated apex.

The species seems to be fairly widely distributed in Santa Clara Province. We are recognizing four subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM

Denticles at the summit distantly spaced.....	seibaboense
Denticles at the summit not distantly spaced.	
Axial ribs distantly spaced.....	obtectum
Axial ribs not distantly spaced.	
Whorls gibbose.....	tenuicostum
Whorls not gibbose.....	guayosense

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM SEIBABOENSE, new subspecies

PLATE 13, FIGURE 4

This race, which was collected by Dr. Bermudez at Vereda de Herrera, Seibabo, Yaguajay, Santa Clara Province, is distinguished from the other three by having all the ribs much more distantly spaced and by having the denticles at the summit stronger and more distantly spaced. In the type there are 30 axial ribs on the first of the remaining whorls and 64 on the last whorl.

The type, U.S.N.M. No. 535452, has 3.2 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 7.3 mm.; lesser diameter, 6.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM OBTECTUM Torre and Henderson

PLATE 13, FIGURE 1

1920. *Opisthosiphon (Opisthosiphona) obtectus* (Torre and Henderson MS.) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68, *nomen nudum*.
1921. *Opisthosiphon (Opisthosiphon) obtectum obtectum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 262-263, pl. 42, figs. 2, 3.

This subspecies, which was described from El Palenque de Taguaya-bon, near Remedios, Santa Clara Province, and which we have also found at Rojas, Remedios, differs from *O. (B.) obtectum seibaboense* in being slenderer, in having the whorls a little more inflated, and in having the axial ribs more pronounced, more closely spaced, and much more numerous. The ribs also have faint indications of obsolete nodules. In the type the first of the remaining whorls has 26 axial ribs, while on the last there are 68.

The type, U.S.N.M. No. 314961, has a little more than 3 whorls remaining and measures: Length, 12.3 mm.; greater diameter, 7.9 mm.; lesser diameter, 5.8 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM TENUICOSTUM Torre and Henderson

PLATE 13, FIGURE 6

1921. *Opisthosiphon (Opisthosiphon) obtectum tenuicostum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 263, pl. 42, figs. 4, 5.

This race comes from Cerro de la Puntilla near Remedios, Santa Clara Province. It differs from *O. (B.) obtectum obtectum* in being more chubby, with the whorls more inflated, the ribs much less strongly developed, and the denticles even more numerous. The outer peristome is also less expanded. In the weakness of the axial ribs it resembles *O. (B.) obtectum seibaboense*. In the type there are 32 axial ribs on the first of the remaining whorls and 80 on the last whorl.

The type, U.S.N.M. No. 314962, has a little more than 3 whorls remaining and measures: Length, 10.2 mm.; greater diameter, 6.7 mm.; lesser diameter, 5.5 mm.

Animals of this subspecies collected by Bartsch on La Puntilla August 5, 1928, were described by him as being dark olivaceous with numerous lighter dots on the papillae. Tentacles pale orange tipped at the slightly expanded end with black, which coloring produces a very striking effect. The animal suspends with a mucous thread when at rest.

OPISTHOSIPHON (BERMUDEZSIPHONA) OBTECTUM GUAYOSENSE, new subspecies

PLATE 13, FIGURE 2

This race comes from the caves near Guayos, in Santa Clara Province. We have also seen it from Las Damas, near Guayos. It differs from the other three subspecies in being much more slender, with the whorls a little less inflated. The ribs are about as strongly developed as those of typical *O. (B.) obtectum obectum*, stronger than in the other two races. The denticulations at the summit also resemble those of typical *obtectum*. In the type there are 30 ribs on the first of the remaining turns and 104 on the last.

The type, U.S.N.M. No. 355514, has a little more than 4 whorls remaining and measures: Length, 12.2 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.2 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) INSULANUM, new species

Shell subcylindric, rather thin, pale straw colored, with interrupted spiral bands of brown. The early whorls are decollated in all our specimens. Those remaining are very strongly inflated and rounded, and crossed by slightly retractorily slanting axial ribs, which are more distantly spaced on the early whorls than on the later, where they are rather closely approximated. These riblets at rather close intervals form slender minute cusps at the summit. The intercostal spaces are marked by microscopic axial threads. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, and marked by the continuation of the axial ribs and in the exposed portion of the umbilicus by a number of spiral cords, which render the axial ribs feebly nodulose at their junctions. Aperture broadly oval; peristome double, the inner exserted, erect; the outer forming a conspicuous auricle at the posterior angle, narrower on the outer and basal lip, and again expanded on the inner lip, where it is strongly notched; the portion posterior to the notch is bent into and plugs the umbilicus. The outer peristome is marked by slender, concentric lamellae. Operculum typically opisthosiphonid. The siphon situated at the posterior angle of the aperture immediately behind the peristome bends into the suture and connects through a slender channel behind the parietal wall of the outer peristome with the umbilicus, the hollow axis, and the decollated apex.

The species appears to be confined to the small islands lying off the Santa Clara coast near Caibarien.

We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) INSULANUM

Suture strongly constricted.....	scopulorum
Suture enormously constricted.....	insulanum

OPISTHOSIPHON (BERMUDEZSIPHONA) INSULANUM SCOPULORUM, new subspecies

PLATE 13, FIGURE 7

This race was collected by Dr. Bermudez on Cayo de la Salina, east of Caibarien. It is distinguished from *O. (B.) insulanum insulanum* by having the suture much less strongly constricted, with the denticles at the summit much more pronounced and less abundant. The outer lip is much more expanded and the interrupted spiral bands are less pronounced. In the type 43 axial ribs are on the first of the remaining turns and 115 are on the last whorl.

The type, U.S.N.M. No. 535454, has 3.5 whorls remaining and measures: Length, 8.4 mm.; greater diameter, 6.1 mm.; lesser diameter, 4.7 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) INSULANUM INSULANUM, new subspecies

PLATE 13, FIGURE 5

This race was collected by Dr. Bermudez on Cayo de la Aguada, east of Caibarien. It is distinguished from *O. (B.) insulanum scopulorum* in having the suture much more strongly constricted, with the denticles at the summit less feeble. The strong constriction gives to the shell an almost pupoid appearance. The type has 35 axial ribs on the first of the remaining turns and 105 on the last whorl.

The type, U.S.N.M. No. 535453, has 3.5 whorls remaining and measures: Length, 10.0 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.7 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) SALUSTII Torre and Henderson

PLATE 13, FIGURE 9

1920. *Opisthosiphon (Opisthosiphona) salustii* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.

1921. *Opisthosiphon (Opisthosiphona) salustii* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 256-257, pl. 40, figs. 5, 7.

Shell very broadly elongate-conic, flesh colored, with 4 interrupted spiral bands of brown on the spire and 3 on the base. The umbilical wall is pale brown and the outer lip of the outer peristome is rayed with brown. Nuclear whorls 2, small, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded and marked by slightly retractively slanting axial ribs, which are very distantly spaced on the early turns and which become gradually more closely approximated as the shell increases in size; on the last turn they are separated by spaces as wide as the riblets. In the type, 32 of these riblets occur upon the first of the remaining turns, 38 upon the second, 66 upon the third, and 108 upon the last.

Some of these riblets become expanded at rather regular intervals at the summit, where they project as slender hollow cusps. The intercostal spaces are marked by microscopic axial threads. Suture strongly constricted. Periphery strongly rounded. Base short, inflated, openly umbilicated, marked by the continuation of the axial riblets and by 3 spiral threads on the edge of the umbilicus, and by 10 within the umbilicus. Last whorl solute for about one-eighth of a turn. Aperture broadly oval; peristome double, the inner exerted and slightly reflected; the outer moderately broadly expanded, a little more so on the inner and the parietal wall than on the rest, and reflected as a broad backward-turned auricle at the posterior angle, which covers the backward-directed siphon. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 314954, comes from Finca Santa Rita near El Cercado, Cubitas Mountains, Camagüey Province. It has a little more than 3 whorls and measures: Length, 10.9 mm.; greater diameter, 8.0 mm.; lesser diameter, 5.9 mm.

The collection also includes a large series of specimens collected by Bartsch at Finca Gertrudis, a little east of the type locality.

OPISTHOSIPHON (BERMUDEZSIPHONA) EVANIDUM Torre and Henderson

Shell elongate-conic, flesh colored except for the plug at the decollated end, which is brown. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, and marked by slender, retractively curved axial riblets, which are very distantly spaced on the early turns and which become gradually more closely approximated. On the last whorl the spaces that separate them are only about twice as wide as the riblets. The intercostal spaces are marked by microscopic axial threads. At more or less regular intervals some of these riblets become expanded and thickened at the summit, where they form conspicuous white hollow denticles. Suture strongly constricted. Periphery strongly inflated, well rounded. Base short, openly umbilicated, inflated, well rounded, and marked by the continuation of the axial riblets and feeble spiral threads on the bend of the umbilicus, and by stronger spiral threads on the umbilical wall. Last whorl solute for about one-fourth of a turn. Aperture broadly oval; peristome double, the outer moderately expanded on the inner lip and at the posterior angle, where it forms a conspicuous auricle that is reflected over the siphon. On the outer and basal lip it extends but slightly beyond the inner peristome; inner peristome slightly exerted and reflected. Operculum typically opisthosiphonid.

The species appears to be confined to the south side of the Cubitas Mountains, Camagüey Province.

We are recognizing two subspecies. These may be differentiated by the following key and descriptions:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) EVANIDUM

Spiral cords of umbilical wall moderately strong----- *evanidum*
Spiral cords of umbilical wall feeble----- *degeneratum*

OPISTHOSIPHON (BERMUDEZSIPHONA) EVANIDUM EVANIDUM Torre and Henderson

PLATE 13, FIGURE 10

1921. *Opisthosiphon (Opisthosiphona) evanidum evanidum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 258, pl. 41, figs. 1, 2.

This subspecies was collected by Torre and Sifontes at Finca La Loma, on the south-central side of the Cubitas Mountains. It differs from *O. (B.) evanidum degeneratum* in being larger, more robust, more inflated, and apparently lacking the faint interrupted spiral band of brown which is usually present in that race. In the type there are 40 axial riblets on the first of the remaining turns and 136 on the last.

The type, U.S.N.M. No. 314950, has a little more than 4 whorls remaining and measures: Length, 12.2 mm.; greater diameter, 8.3 mm.; lesser diameter, 6.1 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) EVANIDUM DEGENERATUM Torre and Henderson

PLATE 13, FIGURE 3

1921. *Opisthosiphon (Opisthosiphona) evanidum degeneratum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 258, pl. 41, figs. 3, 8.

This subspecies was collected by Torre and Sifontes on Monte de Santa Cruz, at the right of Los Cangilones. It differs from the typical race in being always smaller, less inflated, more regularly conic, and in usually having indications of interrupted spiral bands of brown. In the type there are 40 axial ribs on the first of the remaining whorls and 130 on the last turn.

The type, U.S.N.M. No. 314956, has 4.0 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 7.3 mm.; lesser diameter, 5.8 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTURATUM Torre and Henderson

Shell varying from broadly ovate to elongate-ovate in shape and varying in color from horn colored to pale brown, unicolor or with a broad spiral band of darker brown at the periphery; peristome white. Nuclear whorls 2, inflated, strongly rounded, forming an almost cylindric truncated apex. Postnuclear whorls inflated, strongly rounded, and marked by retractively slanting axial ribs, which are distantly spaced on the early turns and which are much more closely

approximated on the later whorls. These riblets at irregular intervals form small, more or less rounded, white, hollow cusps at the summit. The intercostal spaces are marked by microscopic axial hairlines. Suture well constricted. Periphery decidedly inflated, well rounded. Base short, inflated, well rounded, openly umbilicated, and marked by the continuation of the axial ribs and by a series of low equal spiral threads within the umbilicus. The last whorl is solute for about one-fifth of a turn, the outer peristome of the parietal wall sometimes touching the preceding whorl. Aperture broadly ovate; peristome double, the inner exerted, reflected, and appressed to the outer lip, free on the inner lip; the outer peristome is narrow on the outer lip and decidedly expanded on the inner and parietal wall. There is a deep notch on the inner lip, posterior to which the peristome is reflected over the umbilicus, which it partially shields. Operculum typically opisthosiphonid. Siphon behind the posterior angle of the aperture directed backward and free.

The species appears restricted to the western end of the Cubitas Mountains. We are recognizing two subspecies, which the following key and descriptions will differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTURATUM

Shell ovate.....	subobturatum
Shell very broadly ovate.....	tinajaense

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTURATUM SUBOBTURATUM
Torre and Henderson

PLATE 13, FIGURE 8

1920. *Opisthosiphon (Opisthosiphona) subobturatus* HENDERSON and BARTSCH,
Proc. U. S. Nat. Mus., vol. 58, p. 67, MS.
1921. *Opisthosiphon (Opisthosiphona) obturatum subobturatum* TORRE and HEN-
DERSON, Proc. U. S. Nat. Mus., vol. 59, p. 253, pl. 39, figs. 7-11.

This race was collected by Torre, Henderson, and Simpson in the Paso de las Trincheras, in a cave known as Los Indios, Camagüey Province. It is distinguished from *O. (B.) subobturatum tinajaense* in being much less rotund; that is, it is more elongate-ovate and is nearer unicolor. The type has 34 axial ribs on the first of the remaining turns and 130 on the last.

The type, U.S.N.M. No. 314949, has a little more than 4 whorls remaining and measures: Length, 13.5 mm.; greater diameter, 9.2 mm.; lesser diameter, 6.9 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTURATUM TINAJAENSE, new subspecies

PLATE 13, FIGURE 13

This race was collected in large numbers at many stations in Paso de la Tinaja, Cubitas Mountains, the pass west of Trincheras, Camagüey Province. It is distinguished from *O. (B.) subobturatum subobturatum* by its more rotund shape and by its much more conspic-

uous banding. On the first of the remaining turns in the type there are 47 axial ribs, with 133 on the last whorl.

The type, U.S.N.M. No. 535455, comes from the paredones 2.5 km. from the north entrance to Paso de la Tinaja. It has 4.0 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 10.4 mm.; lesser diameter, 8.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) TORREI Welch

PLATE 14, FIGURE 4

1929. *Opisthosiphon torrei* WELCH, Nautilus, vol. 42, p. 98, pl. 5, fig. 3.

1934. *Opisthosiphon (Opisthosiphon) torrei* WELCH, Nautilus, vol. 47, p. 131, pl. 11, fig. 6.

Shell elongate-ovate, thin, pale brown with the axial ribs almost white; peristome pale yellow. Nuclear whorls unknown. Post-nuclear whorls strongly rounded, marked by rather distantly spaced, slender, lamellar axial ribs, which are feebly nodulose, the nodules at the summit and those adjacent to the summit being more pronounced than those on the rest of the turn. At the summit the ribs form slender hollow cusps, which extend up against the wall of the preceding turn. The intercostal spaces are marked by microscopic hairlines. Of these ribs, 27 are present on the last turn of the specimen figured. The spaces between the axial ribs are marked by many microscopic threads. Suture well constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, moderately widely umbilicated, and marked in the outer portion of the umbilicus by 2 feeble spiral threads, which render the axial ribs somewhat spinose at their intersection. Aperture very broadly oval; peristome double, the inner exerted and slightly reflected; the outer broadly expanded and marked by strongly elevated concentric lamellae. The outer peristome is folded on the middle of the inner lip; posterior to the fold it is reflected over the umbilicus. It is adnate to the preceding turn on the parietal wall. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome bent into the suture, evidently communicating with the umbilicus.

The specimen figured, U.S.N.M. No. 425682, is one of two; it has 3.6 whorls remaining and measures: Length, 9.8 mm.; greater diameter, 6.3 mm.; lesser diameter, 4.9 mm. It was collected by Drs. Pilsbry and Welch on a hill east of Chambas River, Florencia, Camagüey Province.

OPISTHOSIPHON (BERMUDEZSIPHONA) CAGUANENSE, new species

PLATE 14, FIGURE 12

Shell elongate-ovate, ranging from pale yellow to brown, unicolor, or interruptedly spirally banded; the dots composing the bands are usually distantly spaced and are arranged in both axial and spiral

series; these dots may be present on both spire and base. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, marked by slightly retractively slanting, sublamellar axial ribs, of which 29 are present on the first whorl and 86 on the last. Almost every other one of these ribs is expanded at the summit into a hollow cusp. The intercostal spaces are wider than the ribs and they are marked by microscopic hairlines. Suture well impressed. Periphery inflated, well rounded. Base moderately long, well rounded, and marked by the continuation of the axial ribs which extend into the umbilicus. The umbilicus is narrowly open and it is marked by a series of concentric spiral threads, which render the axial ribs decidedly nodulose at their junction. Aperture broadly oval; peristome double, the inner slightly exerted, scarcely reflected; the outer broadly expanded, forming somewhat of an auricle at the posterior angle of the aperture, deeply notched on the inner lip, the portion posterior to the notch expanded as a broad flap, which is reflected over the umbilicus, which it partly conceals. The outer peristome is marked by slender concentric lamellae. Operculum typically opisthosiphonid. Siphon situated behind the peristome at the posterior angle of the aperture, directed into the suture.

The type, U.S.N.M. No. 535456, comes from Cayo Caguanes, Yaguajay, Santa Clara Province. It has 4.2 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.2 mm. The type is a little larger than additional specimens before us from the same locality.

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM, new species

Shell ovate, rather thin, varying in color from pale yellow to brown, unicolor, or with faint interrupted spiral bands of brown. Nuclear whorls about 2, small, inflated, strongly rounded, forming a slender truncated apex. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting axial ribs, which are only a trifle more distantly spaced on the early turns than on the last. Most of these ribs expand into tiny cusps at the summit. Intercostal spaces marked by microscopic axial hairlines. Suture strongly constricted. Periphery inflated, well rounded. Base short, inflated, strongly rounded and openly umbilicated, marked by the continuation of the axial ribs and by a series of spiral threads within the umbilicus. These threads render the axial riblets weakly nodulose. Aperture broadly oval, almost subcircular; peristome double, the inner exerted and very slightly expanded; the outer expanded, narrow on the outer and the basal lip, broader at the posterior angle, widest on the inner lip, at the middle of which it is deeply infolded and reflected over the umbilicus. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome directed into the suture.

This species centers about Remedios, Santa Clara Province.

Four subspecies may be differentiated by the following key:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM

Axial ribs moderately strongly developed.

Shell short and pupoid.

Reflected portion of the inner lip of the outer peristome

broad..... subobtectum

Reflected portion of the inner lip of the outer peristome

not broad..... puntillense

Shell not short and pupoid, but elongate..... guajabanense

Axial ribs feeble..... quintanense

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM SUBOBTECTUM,
new subspecies

PLATE 14, FIGURE 2

This subspecies comes from Rojas, near Remedios, Santa Clara Province. It has the suture strongly constricted, which gives it a pupoid aspect. The axial ribs are fairly strongly developed and the outer peristome is very broadly expanded on the inner lip, where it is bent in rather than out. This alone will differentiate it from the other pupiform member, *O. (B.) subobtectum puntillense*. In the type there are 22 axial ribs on the first of the remaining turns and 67 on the last whorl.

The type, U.S.N.M. No. 535458, has 3.5 whorls remaining and measures: Length, 9.5 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.3.

OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM PUNTILLENSE, new
subspecies

PLATE 14, FIGURE 3

In this race also the shape is pupiform, in which respect it resembles typical *O. (B.) subobtectum subobtectum*, from which it is easily distinguished by the much less expanded outer peristome of the inner lip. Like typical *subobtectum*, the spiral threads in the umbilicus are feebly expressed. *O. (B.) subobtectum puntillense* comes from La Puntilla, a block of limestone 2 miles southwest of Remedios, Santa Clara Province. In the type 30 axial ribs are present on the first of the remaining turns and 62 are on the last.

The type, U.S.N.M. No. 535457, has 3.2 whorls remaining and measures: Length, 8.2 mm.; greater diameter, 5.7 mm.; lesser diameter, 4.7 mm.

Animals of this subspecies collected by Bartsch at La Puntilla August 7, 1928, were described by him as being of smoke gray ground color, with a pinkish area about the base of the tentacles; sides with an olivaceous tinge with numerous small, low papillae having many

grayish dots. Sole of the foot a little paler than the sides, deeply medially cleft. The motion may be direct or jerky. The animal suspends by a mucous thread when at rest.

**OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM GUAJABANENSE, new
subspecies**

PLATE 14, FIGURE 13

A large series of specimens of this subspecies were taken by Bartsch on Cerro de Guajabana, near Caibarién. It is most nearly related to *O. (B.) subobtectum quintanense*, but it is readily distinguished from that by its darker color, interrupted spiral bands, and stronger sculpture. There are 46 axial ribs on the first of the remaining whorls and 61 on the last turn.

The type, U.S.N.M. No. 535459, has 3.5 whorls remaining and measures: Length, 12.5 mm.; greater diameter, 7.9 mm.; lesser diameter, 6.0 mm.

Animals of this subspecies, collected by Bartsch at Guajabana August 8, 1928, were described by him as having the dorsal parts sooty, a little paler about the base of the tentacles and eyes. Entire body, except the sole of the foot, covered by numerous flattened papillae, which are made up of many whitish dots. Tentacles sooty with a dusky orange ring about the base. Sole of the foot deeply, medially cleft, smoke gray, with an olivaceous tinge. The animal when at rest suspends by a mucous thread. In this subspecies the male is smaller than the female.

**OPISTHOSIPHON (BERMUDEZSIPHONA) SUBOBTECTUM QUINTANENSE, new
subspecies**

PLATE 14, FIGURE 14

This race was collected by Bartsch at Loma de Quintana, a limestone block about 4 miles slightly southwest of Caibarién, and an equal distance a little east and north of Remedios. This is one of the elongate-ovate members. The shell is pale and the ribs are very poorly developed. In size it approaches *O. (B.) subobtectum guajabanense*, but it is easily distinguished from *guajabanense* by its pale color and feeble sculpture. There are 34 axial ribs on the first of the remaining turns and 68 are on the last whorl.

The type, U.S.N.M. No. 535460, has 3.4 whorls remaining and measures: Length, 11.8 mm.; greater diameter, 7.3 mm.; lesser diameter, 5.9 mm.

Animals of this subspecies were collected by Bartsch at Loma de Quintana on August 9, 1928, and were described by him as having the upper part of smoke-gray color, paler on the forehead, with a pinkish area above the base of the tentacles, which are pale orange tipped with

dark bluish gray, almost black. There are numerous fine dots and streaks on the forehead and dorsum. Sides of the body dark smoky gray with olivaceous suffusion. The numerous flattened papillae are marked by many fine white dots. Sole of the foot smoke gray, deeply medially cleft. Motion direct. The animal suspends by a mucous thread when at rest.

OPISTHOSIPHON (BERMUDEZSIPHONA) AGUILERIANUM (Arango)

Shell very elongate-ovate, straw colored, with or without faint interrupted spiral bands of brown. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming an apex that is in perfect continuation of the rest of the spire. Postnuclear whorls rather high between summit and suture, well rounded, marked by slender sublamellar axial ribs, which form hollow cusps at the summit. The intercostal spaces are marked by microscopic axial hairlines. Suture well impressed. Periphery inflated, strongly rounded. Base rather long, well rounded, and marked by the continuation of the axial ribs, which extend into the moderately broadly open umbilicus, and by several spiral threads in the umbilicus, which render the axial riblets scalloped at their junction. Aperture broadly oval; peristome double, the inner somewhat exserted, slightly reflected; the outer broadly expanded, a little narrower on the basal lip than on the rest, neither notched nor inbent on the inner lip, marked by slender concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture bent backward into the suture.

This species, as far as known, is restricted to Oriente Province. We are recognizing two subspecies, which the following key and descriptions will help to differentiate.

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) AGUILERIANUM

Hollow cusps at the summit very strongly developed.....	aguilermanum
Hollow cusps at the summit weakly developed.....	holguinense

OPISTHOSIPHON (BERMUDEZSIPHONA) AGUILERIANUM AGUILERIANUM (Arango)

PLATE 14, FIGURE 9

1876. *Cyclostoma aguilermanum* ARANGO, An. Acad. Cienc. Med., Fis. Nat. Habana, vol. 12, p. 280.
 1878. *Tudora ? aguilermana* ARANGO, Contribucion a la fauna malacologica Cubana, p. 21.
 1932. *Opisthosiphon aguilermanum* AGUAYO, Nautilus, vol. 45, pp. 92-93.

The typical subspecies was originally described by Arango with no more specific locality than that it was collected in Cuba by Wright. This race was lost for a long time. It was rediscovered by Torre at Gibara. We are figuring Arango's type, U.S.N.M. No. 535461, and a complete specimen of Torre's collecting.

This subspecies may be distinguished from *O. (B.) aguilarianum holguinense* in having the ribs more distantly spaced and the cusps at the summit much stronger. There appears also to be a lesser tendency to banding.

The complete specimen, U.S.N.M. No. 535462, has 21 axial ribs on the first turn and 44 on the last. It has 7.3 whorls and measures: Length, 12.3 mm.; greater diameter, 6.0 mm.; lesser diameter, 4.9 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) AGUILERIANUM HOLGUINENSE Aguayo

PLATE 14, FIGURE 11

1932. *Opisthosiphon aguilarianum holguinense* AGUAYO, Nautilus, vol. 45, p. 93, pl. 6, fig. 1.

This subspecies comes from Cerro San Juan, Sao Arriba, Holguin, Oriente Province. It differs from the typical race in having the axial ribs more numerous, more closely spaced, and less strongly cusped at the summit.

The specimen figured, U.S.N.M. No. 535463, has 35 axial ribs on the first of the remaining turns and 57 on the last. It has 4.4 whorls remaining and measures: Length, 11.8 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.3 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) DETECTUM Torre and Henderson

Shell small, ovate, rather thin, varying in color from pale yellow to pale brown, unicolor, or interruptedly spirally banded. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, and marked by retractively slanting axial riblets, which in the subspecies *murinum* are rather conspicuously nodulose on the posterior portion of the whorls, much less so in the other races where the nodules are scarcely indicated. The intercostal spaces are marked by microscopic axial hairlines. Most of the axial ribs develop into slender hollow cusps at the summit. These vary in strength in the various races. Suture strongly constricted. Periphery of the last whorl inflated, strongly rounded. Base short, moderately openly umbilicated, strongly rounded, marked by the continuation of the axial ribs and within the umbilicus marked by spiral threads, which are also of varying strength and number in the different races. Aperture broadly oval; peristome double, the inner moderately exerted and very slightly reflected; the outer rather broadly expanded, slightly inbent in the middle of the inner lip in two of the races, adnate to the preceding turn at the parietal wall, and marked by concentric laminae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome directed backward into the suture.

We are recognizing three subspecies, which the following key and descriptions will help to characterize:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) DETECTUM

Inner lip of outer peristome slightly inbent in the middle.

Shell unicolor..... **murinum**

Shell interruptedly spirally banded with brown..... **lucasense**

Inner lip of outer peristome not inbent in the middle..... **detectum**

OPISTHOSIPHON (BERMUDEZSIPHONA) DETECTUM MURINUM, new subspecies

PLATE 14, FIGURE 8

This subspecies was collected by Dr. Bermudez on Cayo Ratones, east of Caibarien, Santa Clara Province. It is white or pale yellow and it has the inner lip of the outer peristome slightly flexed and the axial ribs rather conspicuously denticulated. There are no signs of spiral threads in the intercostal spaces.

The type, U.S.N.M. No. 535464, has 39 axial ribs on the first of the remaining turns and 77 on the last. The type has 3.2 whorls remaining and measures: Length, 9.0 mm.; greater diameter, 5.7 mm.; lesser diameter, 4.5 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) DETECTUM LUCASENSE, new subspecies

PLATE 14, FIGURE 7

This race was collected by Dr. Bermudez on Cayo Lucas, east of Caibarien. It lacks the denticulations of the ribs of *O. (B.) detectum murinum* and the ribs are much more closely spaced than in *O. (B.) detectum detectum*. It likewise has scarcely any indications of flexing of the inner lip of the outer peristome.

The type, U.S.N.M. No. 535465, has 22 axial ribs on the first of the remaining turns and 60 upon the last whorl; it has 4.2 whorls remaining and measures: Length, 104 mm.; greater diameter, 6.3 mm.; lesser diameter, 5.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) DETECTUM DETECTUM Torre and Henderson

PLATE 14, FIGURE 10

1920. *Opisthosiphon (Opisthosiphona) detectus* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68, *nomen nudum*.

1921. *Opisthosiphon (Opisthosiphon) detectum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 261-262, pl. 42, fig. 1.

The typical subspecies was collected by Torre at Casimbas de las Llanadas, Sierra de Canoa, Mayajigua, Santa Clara Province. It differs from the other two subspecies in having the axial ribs much more closely spaced, with the denticles at the summit finer. The indication of nodules on the axial ribs occurs only on the early whorls near the summit. There is a slight flexing on the middle of the outer lip.

The type, U.S.N.M. No. 314960, has 39 axial ribs on the first of the remaining turns and 84 on the last whorl; it has 3.8 whorls remain-

ing and measures: Length, 10.3 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.0 mm.

OPISTHOSIPHON (BERMUDEZSIPHONA) BERMUDEZI, new species

PLATE 14, FIGURE 6

Shell small, ovate, thin, pale brown, with yellowish peristome. Nuclear whorls 2, strongly rounded, microscopically granulose. Post-nuclear whorls inflated, strongly rounded, and marked by almost vertical sublamellose axial ribs, which are rather distantly spaced, of which 22 occur on the first and 47 on the last of the remaining turns in the type. These ribs form slender denticles at the summit. Inter-costal spaces broad, marked by microscopic axial threads. Suture very strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs and by several strong spiral cords at the outer edge of the umbilicus and feebler ones within. These cords render the axial ribs scalloped. Umbilicus rather large. Aperture broadly oval; peristome double, the inner exerted and slightly reflected; the outer rather broadly expanded, forming a slight auricle at the posterior angle of the aperture, marked by concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome directed into the suture.

This species appears rather widely distributed among the hills about Vega Alta, Santa Clara Province. We have seen it from Vereda del Abra, Lomas Murciélagos, Sinaloa, and Sola.

The type, U.S.N.M. No. 535466, comes from Loma Murciélagos; it has 3.5 whorls remaining and measures: Length, 8.6 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.7 mm.

Animals of this species, collected by Bartsch at Loma Murciélagos, near Vega Alta, on August 16, 1928, were described by him as being buff above with a decidedly rosy tinge behind the tentacles. Snout a little paler at the tip. Tentacles bright buff, tipped with bluish black. Sides of the body and the deeply cleft sole of the foot pale olivaceous. The motion is steady.

OPISTHOSIPHON (BERMUDEZSIPHONA) ANDREWSI Welch

PLATE 14, FIGURE 1

1929. *Opisthosiphon andrewsi* WELCH, Nautilus, vol. 42, p. 98, pl. 5, fig. 6.

1934. *Opisthosiphon andrewsi* WELCH, Nautilus, vol. 47, p. 130, pl. 11, fig. 5.

Shell small, ovate, thin, pale brown with pale yellow peristome. Nuclear whorls decollated in our specimens. Postnuclear whorls strongly rounded, marked by very distantly spaced lamellose axial ribs, which bear feeble indications of scallops, 17 of which occur on the first and 23 on the last of the remaining turns. These ribs are expanded at the summit into narrow, low cusps. The intercostal spaces

are very broad and they are marked by numerous microscopic axial threads. Suture strongly constricted. Periphery inflated, well rounded. Base short, openly umbilicated, inflated, strongly rounded, and marked by the continuation of the axial ribs and within the umbilicus and its outer edge by low spiral threads, which render the axial ribs nodulose. Aperture broadly oval; peristome double, the inner slightly exserted and reflected, but not adnate to the outer; the outer broadly, flaringly expanded, marked by numerous concentric lamellae, broadest on the inner lip, where it is partly reflected over the umbilicus, and at the posterior angle of the aperture. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture reflected backward into the suture.

The specimen figured, U.S.N.M. No. 425684, is one of 3 paratypes received from Dr. Welch, collected by him on the south slope of Loma de Florencia, Camagüey. It has 4.5 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 7.0 mm.; lesser diameter, 6.1 mm. The extremely distant spacing of the ribs combined with the notch in the inner lip will easily distinguish this from the other Bermudez-siphonas.

Subgenus OPISTHOSIPHONA Henderson and Bartsch

1920. *Opisthosiphona* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Opisthosiphons without spiral sculpture on spire and base, the spiral threads being present in the umbilicus only, and with the axial ribs terminating individually without fusing at the summit. There are no microscopic axial lines between the axial ribs.

Type: *Opisthosiphon (Opisthosiphona) moreletianum* (Petit).

KEY TO THE SPECIES OF THE SUBGENUS OPISTHOSIPHONA

Umbilicus closed.....	pupoides
Umbilicus open.	
Last whorl decidedly solute.....	moreletianum
Last whorl slightly solute.....	plicatum
Last whorl not solute.....	turiguanoense

OPISTHOSIPHON (OPISTHOSIPHONA) PUPOIDES (Morelet)

Shell elongate-conic, varying from flesh colored to pale brown, marked by interrupted spiral bands of brown, the elements composing these bands being arranged in both axial and spiral series. Nuclear whorls 2, inflated, well rounded, microscopically granulose. Post-nuclear whorls inflated, strongly rounded, marked by retractively slanting axial riblets, which extend very prominently to the summit, where they become expanded into hollow cusps, usually weaker ones alternating with stronger ones. Suture strongly constricted, crenulated by the denticles at the summit. Periphery inflated, well rounded:

Base strongly rounded, with closed umbilicus, marked by the continuation of the axial ribs and by several spiral threads within the umbilicus. Last whorl adnate to the preceding turn. Aperture broadly oval; peristome double, the inner slightly exerted and reflected; the outer broadly expanded and reflected, somewhat sinuous, marked by concentric lamellae, notched on the middle of the inner lip, the part posterior to the notch reflected over the umbilicus, which it closes. Operculum typically opisthosiphonid, rather large—too large to be withdrawn within the aperture. Siphon at the posterior angle of the aperture directed backward into the suture, from which it communicates by a channel behind the parietal outer lip with the umbilicus, the hollow axis, and the decollated tip.

We are recognizing three subspecies, all from the Isle of Pines, which the following key and descriptions will help to differentiate.

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (OPISTHOSIPHONA) PUPOIDES

- Suture decidedly channeled..... pupoides
 Suture not decidedly channeled.
 Axial ribs of last whorl very closely spaced..... velazquezi
 Axial ribs of last whorl not very closely spaced..... bibijaguaense

OPISTHOSIPHON (OPISTHOSIPHONA) PUPOIDES PUPOIDES, new subspecies

PLATE 15, FIGURE 4

1849. *Cyclostoma pupoides* MORELET, Testacea novissima insulae Cubana et Americae Centralis, p. 23.
 1852. *Tudora pupoides* FREIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 180.
 1920. *Opisthosiphon (Opisthosiphona) pupoides* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Bartsch collected this subspecies in large numbers at many stations in the Sierra de Casas. It closely resembles typical *O. (O.) pupoides velazquezi* but may be differentiated by the deeply channeled suture.

The specimen figured, U.S.N.M. No. 535467, came from the south end of the west side of the Sierra de Casas. It has 44 axial ribs on the first remaining postnuclear whorl and 112 on the last; it has 7.0 whorls remaining and measures: Length, 17.8 mm.; greater diameter, 9.5 mm.; lesser diameter, 7.0 mm.

OPISTHOSIPHON (OPISTHOSIPHONA) PUPOIDES VELAZQUEZI, new subspecies

PLATE 15, FIGURE 6

We have seen this subspecies from many stations in the Sierra de Caballos. It is differentiated from *O. (O.) pupoides casasense* in having the suture not conspicuously channeled, with the outer peristome more strongly, obliquely reflected.

The type figured, U.S.N.M. No. 392000, is one of a series collected by Bartsch. It has 27 axial ribs on the first whorl and 147 on the last;

it is a complete specimen having 7.0 whorls and measuring: Length, 17.2 mm.; greater diameter, 9.2 mm.; lesser diameter, 7.0 mm.

OPISTHOSIPHON (OPISTHOSIPHONA) PUPOIDES BIBIJAGUAENSE, new subspecies

PLATE 15, FIGURE 3

Bartsch collected this subspecies in the Sierra de Bibijagua, Isle of Pines. It is decidedly smaller than the other two, and it has the channeling of the suture about halfway between the two.

The type, U.S.N.M. No. 535432, has 42 axial ribs on the first of the remaining turns and 95 on the last; it has 4.4 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 8.0 mm.; lesser diameter, 5.8 mm.

OPISTHOSIPHON (OPISTHOSIPHONA) MORELETIANUM (Peltt)

Shell elongate-conic, varying from flesh color through buff to pale brown, unicolor, or interruptedly spirally banded. The elements making up the spiral bands are usually arranged in both axial and spiral series. Nuclear whorls 2, well rounded, microscopically granulose, with the last portion of the last turn showing faint indications of the postnuclear axial sculpture. Postnuclear whorls strongly rounded, marked by retractively curved, slender axial riblets, which are about one-third as wide as the spaces that separate them. The axial riblets become expanded at the summit to form slender denticles. Suture moderately constricted, rendered crenulated by the denticles at the summit. Periphery inflated, well rounded. Base strongly rounded, openly umbilicated, marked by the continuation of the axial riblets, which extend into the umbilicus. Within the umbilicus and just outside of it a number of spiral threads are present. The last whorl is decidedly solute. The parietal peristome may almost touch the preceding whorl, but there is always at least a small slit between them. Aperture oval; peristome double, the inner moderately exserted and very slightly expanded; the outer is broadly expanded and marked by slender, raised, concentric lamellae; the outer peristome also forms a conspicuous auricle at the posterior angle where it is slightly reflected. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture immediately behind the reflected peristome.

This species comes from the Isle of Pines.

We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (OPISTHOSIPHONA) MORELETIANUM

Axial ribs of last whorl closely spaced..... **columbense**
 Axial ribs of last whorl not closely spaced..... **moreletianum**

OPISTHOSIPHON (OPISTHOSIPHONA) MORELETIANUM COLUMBENSE, new subspecies

PLATE 15, FIGURE 5

This subspecies was collected by Bartsch at the Mogote Columbia, a limestone block southeast of the Sierra de Caballos. It differs from the typical *O. (O.) moreletianum moreletianum* in being much smaller and in having the axial ribs much more closely approximated.

In the type, U.S.N.M. No. 535468, the first postnuclear whorl has 30 axial ribs, while the last has 102. This is a complete specimen having 6 whorls and measuring: Length, 12.5 mm.; greater diameter, 7.2 mm.; lesser diameter, 5.3 mm.

OPISTHOSIPHON (OPISTHOSIPHONA) MORELETIANUM MORELETIANUM (Petit)

PLATE 15, FIGURE 2

1849. *Cyclostoma disjunctum* MORELET, Testacea novissima insulae Cubana et Americae Centralis, p. 23. Not *Cyclostoma disjunctum* Matheron, Ann. Sci. Midi France, vol. 3, p. 59, 1832.
1850. *Cyclostoma moreletiana* PETIT, Journ. Conchyl., vol. 1, p. 46, February 15.
1850. *Cyclostoma moreleti* PFEIFFER, Zeitschr. Malakozool., vol. 7, pp. 88-89, August.
1852. *Tudora moreletiana* PFEIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 180.
1920. *Opisthosiphon (Opisthosiphona) moreletiana* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

The typical race comes from the Sierra de Casas where we found it on both the northern and southern half. It is differentiated from *O. (O.) moreletianum columbense* in being larger and in having the axial ribs more distantly spaced.

The specimen figured, U.S.N.M. No. 391711, has 35 axial ribs on the first postnuclear whorl and 71 on the last turn. It is a complete specimen of 6.8 whorls and measures: Length, 14.0 mm.; greater diameter, 8.2 mm.; lesser diameter, 5.7 mm.

The shell grows considerably larger than this, but we selected it because it was nearly complete. A specimen having 5 whorls remaining measures: Length, 17.3 mm.; greater diameter, 10.2 mm.; lesser diameter, 7.0 mm.

OPISTHOSIPHON (OPISTHOSIPHONA) PLICATUM, new species

PLATE 15, FIGURE 1

Shell elongate-ovate, thin, pale brown with interrupted spiral bands of darker brown. Nuclear whorls almost 2, strongly inflated and well rounded, microscopically granulose, forming a truncated apex. The last of the nuclear turns shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, and marked by retractively curved axial ribs, which are sublamellar on the early turns, but which are reduced to rounded threads on the last whorl.

The type has 46 of these ribs on the first postnuclear whorl and 104 on the last turn. These ribs almost alternately, though irregularly, form hollow cusps at the summit. Sometimes a second nodule appears on the ribs below the cusp at the summit. Suture strongly constricted. Periphery inflated, well rounded. Base short, well rounded, openly umbilicated, marked by the continuation of the axial ribs and by 5 spiral threads, within the umbilicus; these threads grow consecutively stronger toward the outer edge of the umbilicus. Umbilicus open. Last whorl solute for a fraction of a turn, although the outer peristome at the parietal wall usually touches or is adnate to the preceding turn. Aperture broadly oval; peristome double, the inner slightly exserted; the outer broadly expanded, more so on the inner lip than on the outer, marked by concentric laminae. The outer peristome is deeply infolded on the middle of the inner lip, hence the name. It forms a slight auricle at the posterior angle of the aperture. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture directed into the suture.

The type, U.S.N.M. No. 493371, comes from the Sierra de Caballos, Isle of Pines. It has 4.4 whorls remaining and measures: Length, 14.6 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.3 mm.

The plication of the inner lip of the outer peristome will readily distinguish this species from *O. (O.) moreletianum*.

OPISTHOSIPHON (OPISTHOSIPHONA) PLICATUM *subspecies?*

On the Isle of Pines, off Punta Colombo, on a small island known as Morrillo del Diablo, Bartsch collected a lot of dead shells, U.S.N.M. No. 391972, which are too poor to serve for description. These appear to be a distinct subspecies of *plicatum*. The place was so heavily infested with spinose cacti that collecting was next to impossible.

OPISTHOSIPHON (OPISTHOSIPHONA) TURIGUANOENSE, *new species*

PLATE 15, FIGURE 7

Shell elongate-ovate, pale chestnut-brown, the peristome white with a brownish flush. Nuclear whorls 2, somewhat inflated, well rounded, microscopically granulose, forming a blunt apex. The first postnuclear whorls with rather distantly spaced, sublamellar axial ribs, which on the succeeding turns become reduced and more approximated, and which become rather feebly expressed on the last turn. These ribs become expanded at the summit into broad, white, hollow cusps. Of these ribs, 27 are present on the first whorl and 120 are on the last. Suture moderately constricted, rendered conspicuous by the white cusps of the axial ribs. Periphery slightly inflated, well rounded. Base moderately long, well rounded, and marked by the

continuation of the axial ribs and marked within the umbilicus by several whitish threads, which render the axial ribs feebly nodulose. The umbilicus is moderately wide but is shielded largely by the reflected peristome. Aperture broadly oval; peristome double, the inner exserted and slightly reflected; the outer forming a conspicuous auricle at the posterior angle, narrow on the basal half of the outer lip and the basal lip, and broadly expanded on the inner lip, on the middle of which it is somewhat inbent. On the parietal wall it forms a broad flap, which is adnate to the preceding turn. The entire outer peristome is marked by slender, constricted laminae. Operculum typically opisthosiphonid. Siphon at the posterior angle reflected backward into the suture.

A large series of specimens were collected on Signal Hill and the other hilltop on Turiguanó Island.

The type, U.S.N.M. No. 535469, has 4.4 whorls remaining, and measures: Length, 13.8 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.0 mm.

CUBITASIPHONA, new subgenus

The members of this subgenus have axial ribs which at more or less regular intervals are gathered into tufts or cusps at the summit. No fine axial threads are present in the intercostal spaces. The spiral sculpture is confined to the umbilicus. In some species there is a tendency toward nodulation or vertebration of the axial ribs, particularly on the early whorls; this condition lends a false appearance of spiral threads, but in every such instance the intercostal spaces fail to show even a trace of spiral sculpture.

Type *Opisthosiphon* (*Cubitasiphona*) *poeyi*, new species.

KEY TO THE SPECIES OF THE SUBGENUS CUBITASIPHONA

Umbilicus closed.

Axial ribs very fine..... **poeyi**

Axial ribs not very fine.

Inner peristome very strongly protracted..... **protractum**

Inner peristome not very strongly protracted.

Suture strongly constricted..... **claudens**

Suture not strongly constricted..... **guanajaense**

Umbilicus not closed.

Last whorl adnate to preceding turn.

Axial ribs stout and coarse.

Nodulation on axial ribs conspicuous..... **quinti**

Nodulation on axial ribs absent.

Middle of inner lip of outer peristome slightly notched..... **manatiense**

Middle of inner lip of outer peristome not slightly notched..... **bioscal**

- Axial ribs not stout and coarse.
 Inner lip of outer peristome flexed or notched.
 Shell elongate-ovate.
 Inner lip of outer peristome flexed in the middle..... *cunaguae*
 Inner lip of outer peristome notched in the middle..... *judasense*
 Shell not elongate-ovate.
 Shell ovate-conic.
 Tufts at the summit regular and strong... *sanchezi*
 Tufts at the summit irregular and feeble.... *sosai*
 Shell not ovate-conic.
 Shell ovate.
 Umbilicus very wide..... *litorale*
 Umbilicus only moderately wide..... *berryi*
 Inner lip of outer peristome not flexed or notched..... *tersum*
 Last whorl not adnate to the preceding turn, but solute.
 Outer peristome of inner lip flaringly expanded..... *apertum*
 Outer peristome of inner lip not flaringly expanded.
 Outer peristome of inner lip reflected backward..... *deviatum*
 Outer peristome of inner lip not reflected backward... *paredonense*

OPISTHOSIPHON (CUBITASIPHONA) POEYI, new species

PLATE 15, FIGURE 8

Shell moderately large, ovate, varying in color from pale straw color to chestnut-brown, unicolor or interruptedly spirally banded. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a rather blunt apex. Postnuclear whorls inflated, strongly rounded, marked by numerous, closely spaced, slender axial riblets which are as wide as or a little narrower than the spaces that separate them. In the type 62 of these ribs are present on the first of the remaining turns and 255 are on the last whorl. Groups of these riblets, which are somewhat irregularly spaced, are gathered into hollow tufts at the summit; the riblets between the tufts terminate normally. Suture well constricted. Periphery inflated, strongly rounded. Base short, well rounded, marked by the continuation of the axial ribs. Aperture broadly oval; peristome double, the inner somewhat exerted and reflected, particularly so on the basal lip; on the parietal and outer lip it projects materially. The outer peristome forms an auricle at the posterior angle; it is narrow on the outer and basal lip and it becomes expanded on the inner lip and very widely expanded on the parietal wall. It is notched on the middle of the inner lip, and the broad flap posterior to the notch covers the umbilicus and part of the base. On the parietal wall the outer peristome expands materially over the preceding whorl, to which it is adnate. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 535470, was collected by Bartsch on paredones 2.5 km. from the north entrance of Paso de la Tinaja, Cubitas Mountains, Camagüey Province. It has 4.3 whorls remaining and measures: Length, 13.9 mm.; greater diameter, 8.1 mm.; lesser diameter, 7.0 mm. A large series of specimens were collected at various stations through this pass.

This species is named for Federico Poey, grandson of the great Felipe Poey. Federico Poey is a chemist at the Central Jaronú. In 1928 he assisted Bartsch materially in making his explorations of the Cubitas Mountains.

OPISTHOSIPHON (CUBITASIPHONA) PROTRACTUM Torre and Henderson

PLATE 15, FIGURE 9

1920. *Opisthosiphon (Opisthosiphona) protractus* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68, *nomen nudum*.

1921. *Opisthosiphon (Opisthosiphon) protractum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 259-260, pl. 41, figs. 5, 11.

Shell elongate-conic, varying from flesh color to pale brown, marked by interrupted spiral bands of brown, the interior of the aperture varying with the external color; the peristome is flesh colored or tinged with pale brown. Nuclear whorls 2, small, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, marked by slender, retractively slanting axial riblets, which are distantly spaced on the early turns and which become more closely approximated as the shell increases in size; on the last turn they are separated by mere impressed lines. In the type 42 of these riblets occur upon the first of the remaining turns, 82 upon the second, 150 upon the third, and 164 upon the last. At irregular intervals several of these riblets are gathered into hollow tufts at the summit, those between them terminating normally; these tufts are best developed on the last turn and they become feebler toward the early whorls. Suture well constricted. Periphery strongly rounded. Base rather long, well rounded, marked by the continuation of the axial riblets and by several spiral threads within the umbilicus. The umbilicus itself is covered by a reflection of the outer peristome. Aperture broadly oval; peristome double, the inner very strongly exerted and slightly expanded on the outer lip; the outer rather broadly expanded on the parietal wall, less so on the inner lip, and only narrowly so on the outer lip, forming a conspicuous auricle at the posterior angle, which is rendered irregular by the siphon at the posterior angle of the aperture. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 314958, was collected by Dr. Thomas Barbour at Moron, San Juan de los Perros, Camagüey Province. It

has a little over 4 whorls remaining and measures: Length, 15.7 mm.; greater diameter, 9.1 mm.; lesser diameter, 6.9 mm.

Specimens collected by Bartsch at Punta Alegre west of the gypsum mines, on August 25, 1928, enabled him to describe the animal as being pale olivaceous, with the top of the head and the area behind the tentacles a little lighter with a pinkish flush. The entire dorsal part is marked with numerous fine dots. Sides of the body pale olivaceous, with numerous whitish papillae. Tentacles gray, with the base the same shade as the body, the extreme tip a little paler. Sole of the foot deeply cleft, of the same shade as the sides. The animal when at rest suspends itself by a mucous thread.

OPISTHOSIPHON (CUBITASIPHONA) CLAUDENS, new species

PLATE 16, FIGURE 9

Shell elongate-ovate, white, with interrupted spiral bands of brown. Nuclear whorls decollated in all our specimens. The early postnuclear whorls are marked by distantly spaced lamellose axial riblets, which show faint indications of feeble nodulations. On the last two turns these nodulations disappear. The axial riblets become more closely spaced and rounded on the early turns, where they are gathered into hollow tufts at the summit at more or less regular intervals. In the type 27 of these ribs are present on the first of the remaining turns and 176 are on the last. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and in the exposed portion of the umbilicus by 4 slender, spiral threads, which render the axial riblets nodulose. Aperture broadly oval; peristome double, the inner rather strongly exerted; the outer narrow on the outer and basal lip, wider on the inner lip and parietal wall, forming a moderately strong auricle at the posterior angle of the aperture, marked by concentric laminae. The outer peristome is notched on the middle of the inner lip, and the portion posterior to the notch is reflected over the umbilicus, which it plugs. All our specimens are dead; we have not seen an operculum but all the other characters are typical of *Cubitasiphona*. The siphon is at the posterior angle of the aperture and is reflected backward into the suture. It appears to connect with the hollow axis behind the parietal peristome, and through it with the decollated apex.

The type, U.S.N.M. No. 355510, was collected by A. Rojas in the Sierra de Judas, Mayajigua, Santa Clara Province. It has 5.5 whorls remaining and measures: Length, 14.0 mm.; greater diameter, 7.1 mm.; lesser diameter, 6.1 mm.

OPISTHOSIPHON (CUBITASIPHONA) GUANAJAENSE, new species**PLATE 16, FIGURE 2**

Shell elongate-ovate, thin, pale brown, marked with interrupted spiral bands of chestnut-brown; aperture flesh colored rayed with brown. The plug at the truncated apex is chestnut-brown. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded and marked by retractively slanting axial riblets, which are a little more distantly spaced on the first turn than on the succeeding whorls. Here, too, they are rather conspicuously nodulose; the nodules would lead one to believe that this part of the shell possessed spiral sculpture. There are, however, no indications of spiral threads in the intercostal spaces. On the second turn the nodulation becomes much enfeebled and there is only one set of scallops anterior to the summit. This condition is also true of the last turn. These ribs are gathered into rather coarse, conspicuous, hollow tufts at the summit; 44 axial ribs are present on the first of the remaining turns, and 120 are on the last whorl in the type. Suture not strongly constricted. Periphery inflated, well rounded. Base moderately long, well rounded marked by the continuation of the axial ribs and by 6 spiral threads on the exposed portion of the umbilicus, where they render the axial ribs conspicuously scalloped. Aperture broadly oval; peristome double, the inner moderately exerted; the outer flaringly expanded, forming a moderately strong auricle at the posterior angle, narrower at the junction of the basal and outer lip, and deeply notched on the middle of the inner lip, the portion posterior to the notch being reflected over the umbilicus, which it plugs. Operculum typically opisthosphonid. Siphon at the posterior angle of the aperture directed into the suture, connecting through a channel with the umbilicus, the hollow axis, and the truncated apex of the shell.

The type, U.S.N.M. No. 535471, was collected by Bartsch in Paso de la Guanaja, Cubitas Mountains, Camagüey Province. It has 3.5 whorls remaining and measures: Length, 11.9 mm.; greater diameter, 7.5 mm.; lesser diameter, 5.3 mm.

OPISTHOSIPHON (CUBITASIPHONA) QUINTI, new species**PLATE 16, FIGURE 10**

Shell elongate-ovate, of flesh-colored or yellowish ground color, marked by interrupted spiral bands of brown. Peristome flesh colored showing the brown bands as rays on the outer peristome. Nuclear whorls 2, small, well rounded, microscopically granulose, forming a truncated conic spire, the outline of which corresponds with the rest of the shell. Postnuclear whorls moderately strongly rounded, marked by numerous, almost vertical or slightly retractively slanting, sub-

lamellar axial ribs, which are separated by spaces a little wider than the ribs. Some of these ribs become fused to form hollow cusps at the summit. Of these ribs 118 are present on the last whorl. These ribs have indications of fine scallops, which would lead one to believe that spiral threads were present. Under the microscope the fact is revealed that the intercostal spaces are free of spiral threads. Of these scallops 15 are present between summit and periphery on the last turn and 5 are on the base. In the latter place they become increasingly stronger from the periphery toward the umbilicus. Within the umbilicus stronger spiral threads are present, which render the axial ribs decidedly scalloped. Suture strongly impressed. Periphery well rounded. Base rather short, well rounded, narrowly, openly umbilicated. Aperture very broadly oval, almost subcircular; peristome double, the inner rather strongly exerted and straight; the outer broadly expanded and obliquely reflected, notched in the middle of the inner lip and reflected over the peristome posterior to the notch as a broad flap, which extends over and is adnate to the preceding turn at the parietal wall. The outer peristome forms a fairly conspicuous auricle at the posterior angle, and it is marked by concentric lamellae. The siphon is at the posterior angle, behind the peristome, and is reflected into the suture.

The type, U.S.N.M. No. 535472, has 4.3 whorls remaining and measures: Length, 14.1 mm.; greater diameter, 8.8 mm.; lesser diameter, 7.0 mm.

This species was collected by Bartsch on Signal Hill, Turiguanó Island, on the north coast of Camagüey. It is named for A. A. Quint, who was very helpful to him during his stay on Turiguanó.

OPISTHOSIPHON (CUBITASIPHONA) MANATIENSE, new species

PLATE 16, FIGURE 4

Shell elongate-ovate; early whorls pale brown, the rest almost white in the type, which is a dead specimen. Nuclear whorls decollated. Postnuclear whorls well rounded, marked by slightly retractorily curved axial ribs, which are sublamellar and rather distantly spaced on the first turn, and which gradually change as the whorls progress to low, rounded, closely approximated elements. These ribs are gathered into hollow tufts at the summit, at irregular intervals. There are 52 on the first of the remaining turns and 93 are on the last whorl. Suture strongly constricted. Periphery inflated, well rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs and by several spiral threads. Spiral threads apparently are also present within the umbilicus. These spiral threads render the axial riblets scalloped at their junctions. Aperture broadly oval; peristome double, the inner well exerted; the outer expanded, being a

little narrower at the junction of the outer and basal lip, forming a moderately strong auricle at the posterior angle. On the middle of the inner lip the outer peristome is somewhat inbent. The entire surface of the outer peristome is marked by concentric laminae. Operculum? Siphon at the posterior angle of the aperture directed backward into the suture.

The type, U.S.N.M. No. 535473, was collected by Torre at Mono Ciego, on the west side of the entrance of the port of Manati, Oriente. It has 3.5 whorls remaining and measures: Length, 10.0 mm.; greater diameter, 5.5 mm.; lesser diameter, 4.7 mm.

OPISTHOSIPHON (CUBITASIPHONA) BIOSCAI Torre and Henderson

PLATE 16, FIGURE 8

1920. *Opisthosiphon (Opisthosiphona) bioscai* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.

1921 *Opisthosiphon (Opisthosiphona) bioscai bioscai* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 256, pl. 40, figs. 4, 6.

Shell elongate-ovate, flesh colored with a brownish tinge, sometimes pale brown, marked by interrupted spiral bands of brown, the elements composing these bands being arranged in both axial and spiral series; the interior of the aperture is flesh colored; the peristome is flesh colored with a yellowish tinge. Nuclear whorls 1.5, very small, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the axial ribs. Postnuclear whorls well rounded, marked by retractively curved axial ribs, which are rather feebly developed on the early turns, becoming broad, low, and rounded on the succeeding whorls. In the type 72 of these ribs occur upon the first of the remaining turns, 102 upon the second, and 124 upon the last. Some of these ribs at irregular intervals are fused and expanded at the summit into hollow cusps, while others terminate a little short of the summit. Suture moderately constricted. Periphery well rounded. Base moderately long, well rounded, openly umbilicated, marked by the axial ribs and 2 strong, spiral cords on the outside of the umbilicus, and by 2 more strong, spiral cords anterior to these, which are much less conspicuous, while the umbilical wall on the inside is marked by a number of feeble, spiral lines of nodules. The junction of the axial ribs and the spiral threads in the umbilicus causes the axial ribs to become expanded into clawlike elements. Aperture broadly oval; peristome double, the inner slightly exserted and slightly expanded; the outer very broadly expanded on the parietal wall and very broadly reflected over the umbilicus, which it completely hides when viewed squarely; it is reflected over the preceding turn on the parietal wall and is adnate to it. The outer peristome is much narrower on the outer lip, but it is conspicuously expanded at the

posterior angle, where it is rendered irregular by the siphon, which bends backward at the suture behind the peristome. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 314952, was collected by Torre and Henderson at El Cercado, Sierra de Cubitas, Camagüey Province. It has a little over 4 whorls remaining and measures: Length, 14.3 mm.; greater diameter, 9.3 mm.; lesser diameter, 7.1 mm.

Bartsch also collected specimens of this species at La Caridad de Cangilonés and Finca Gertrudis, places near the type locality.

The animals of this species, collected by Bartsch at El Cercado de Mendoza, near Senado, September 2, 1928, were described by him as being flesh colored with a faint olivaceous flush. The dorsal parts are marked with fine dots and with short streaks, and there is a pinkish area behind the tentacles. Sides with many white flattened papillae, which are made up of many fine white dots. Tentacles smoke gray with olivaceous tip. Sole of the foot the same color as the sides, minus the white dots.

OPISTHOSIPHON (CUBITASIPHONA) CUNAGUAE Welch

PLATE 16, FIGURE 3

1929. *Opisthosiphon cunaguae* WELCH, Nautilus, vol. 42, p. 98, pl. 5, figs. 4, 5.

1934. *Opisthosiphon* (*Opisthosiphon*) *cunaguae* WELCH, Nautilus, vol. 47, p. 132, pl. 11, fig. 7.

Shell elongate-ovate, varying in color from flesh color through pale yellow to dark chestnut-brown, unicolor or with interrupted spiral bands. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a blunt apex. Postnuclear whorls inflated, strongly rounded, the early ones more so than the later, marked by retractively curved axial riblets, of which those on the early turns are lamellar and thickened at intervals to form elongated nodules. These nodules gradually become reduced and disappear on the last turn, where the ribs are well rounded and narrower than the spaces that separate them. The axial ribs are gathered into hollow tufts at the summit at rather close intervals. The specimen figured has 36 of these ribs present on the first whorl and 122 on the last turn. Suture well constricted. Periphery well rounded. Base rather short, well rounded, marked by the continuation of the axial ribs and by strong spiral cords, which cover the umbilical wall and which render the axial ribs decidedly scalloped at their junctions. Aperture broadly oval; peristome double, the inner strongly exerted and slightly reflected at the outer edge; the outer expanded, less so on the basal half of the outer lip, forming a rather conspicuous auricle at the posterior angle; very broadly expanded on the upper portion of the inner lip, on the middle

of which there is an infolding, posterior to which the broad flap is reflected over the umbilicus. The outer peristome is marked by concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture directed backward into the suture.

The specimen figured, U.S.N.M. No. 535474, a topotype, was collected by Drs. Pilsbry and Welch at Loma Cunagua, Camagüey Province. It has 3.6 whorls remaining and measures: Length, 13.0 mm.; greater diameter, 8.0 mm.; lesser diameter, 6.1 mm.

Bartsch collected a large series on the same limestone block but on the other side. These specimens also show the color variation described for the species.

OPISTHOSIPHON (CUBITASIPHONA) JUDASENSE Torre and Henderson

PLATE 16, FIGURE 1

1920. *Opisthosiphon (Opisthosiphona) judacensis* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68, *nomen nudum*.
1921. *Opisthosiphon (Opisthosiphon) judasense* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 260-261, pl. 41, figs. 9, 10.

Shell elongate-conic, ranging from pale brown to darker brown, marked by interrupted spiral bands of dark brown. These bands are almost continuous, and the elements composing them are arranged in both axial and spiral series; interior of the aperture varying with the color of the outside, but always paler than the outside; peristome yellowish white, the outer rayed by the brown bands. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by retractively slanting, somewhat sinuous axial riblets, which are distantly spaced on the early turns and which become more closely approximated as the shell increases in size. In the type 42 of these riblets are present upon the first of the remaining turns, 88 upon the second, 148 upon the third, and 186 upon the last. At more or less regular intervals a number of these riblets extend prominently above the rest and become fused to form a hollow cusp. Suture well constricted. Periphery strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and within the umbilicus by a series of slender, spiral threads. Aperture very broadly oval, almost subcircular; peristome double, the inner slightly exserted and slightly reflected; the outer broadly, flaringly expanded, a little wider on the inner lip than on the outer, deeply notched on the middle of the inner lip, the portion posterior to the notch being reflected over the umbilicus which it completely overshadows; on the parietal wall the peristome is adnate to the preceding turn; it also forms a conspicuous auricle at the posterior angle of the aperture, which is rendered somewhat

irregular by the siphon immediately behind it. The outer peristome is marked by a series of wavy, concentric lines. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 314959, was collected by Dr. Thomas Barbour near Mayajigua, in the Sierra de Judas, Santa Clara Province. It has a little over 3 whorls remaining and measures: Length, 13.5 mm.; greater diameter, 9.1 mm.; lesser diameter, 6.1 mm.

OPISTHOSIPHON (CUBITASIPHONA) SANCHEZI, new species

PLATE 16, FIGURE 5

Shell ovate-conic, yellowish white, with a somewhat watered-silk effect. Nuclear whorls 1.5, small, somewhat inflated, well rounded, microscopically granulose. Postnuclear whorls strongly inflated, marked by slightly retractorily curved, sublamellar axial ribs, which are more distantly spaced on the early turns than on the later, becoming closely approximated on the last whorl. Of these ribs, 30 are present on the first of the remaining turns and 222 are on the last. Some of these ribs at quite regular intervals are gathered into bold, hollow tufts at the summit. Suture moderately constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and by feeble spiral threads, which become intensified within the umbilicus. Aperture broadly oval; peristome double, the inner slightly exerted; the outer broadly expanded, forming a very conspicuous auricle at the posterior angle and deeply infolded on the middle of the inner lip. Posterior to the fold a broad expanded flap almost covers the umbilicus. The outer peristome is marked by numerous concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome directed into the suture.

The type, U.S.N.M. No. 535475, and a large series of specimens were collected by Bartsch on Loma de Santa Cruz near Central Senado, Camagüey Province. The type has almost 4 whorls remaining and measures: Length, 12.4 mm.; greater diameter, 8.8 mm.; lesser diameter, 6.2 mm.

This species is very variable in size. An adult specimen of 3.3 whorls measures: Length, 9.0 mm.; greater diameter, 6.6 mm.; lesser diameter, 5.3 mm.

Animals of this species were collected by Bartsch on Santa Cruz Mountain, near Senado, September 6, 1928. His description follows: Dorsal part deeply olivaceous with a pinkish area behind the tentacles. The whole dorsal surface is marked by fine white dots and by short streaks, most concentrated a little before and behind the tentacles. Sides dark olivaceous, marked by rather large white spots, which are composed of numerous fine dots. Sole of foot pale olivaceous. Tentacles with a pale orange wash.

OPISTHOSIPHON (CUBITASIPHONA) SOSAI, new species**PLATE 16, FIGURE 6**

Shell ovate-conic, white or pale yellow. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, and marked by retractively slanting axial riblets which are distantly spaced and sublamellar on the early turns and which are rounded and rather closely approximated on the last whorl. Of these riblets, 31 occur on the first of the remaining turns and 162 are on the last. At irregular intervals these riblets are gathered into hollow cusps at the summit. Suture strongly constricted. Periphery decidedly inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs. Within the umbilicus and on its outer edge a series of slender spiral cords are present that render the riblets feebly scalloped at their junction. Aperture broadly oval; peristome double, the inner exserted and slightly reflected; the outer narrow on the outer and basal lip, expanded into a conspicuous auricle at the posterior angle, and broadly expanded on the inner lip, on the middle of which it shows a conspicuous fold. Posterior to this fold it is reflected partly over the umbilicus. The entire outer peristome is marked by numerous, concentric lamellae. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture directed backward into the suture.

The type, U.S.N.M. No. 535476, comes from Loma Caracuna, Finca Marchena, Siboney, Camagüey Province. It has 3.8 whorls remaining and measures: Length, 11.2 mm.; greater diameter, 8.3 mm.; lesser diameter, 6.3 mm.

OPISTHOSIPHON (CUBITASIPHONA) LITORALE, new species**PLATE 16, FIGURE 7**

Shell broadly ovate, pale brown with a peripheral chestnut-brown band. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked on the first of the remaining turns by very slender, distantly spaced axial riblets, which become finer and more closely approximated as the whorls increase in number. They are exceedingly fine on the last turn. At distant intervals these riblets are gathered into inconspicuous cusps at the summit. In the type 53 of the axial ribs are present on the first turn and 192 on the last. Suture strongly constricted. Periphery inflated, very strongly rounded. Base short, very broadly, openly umbilicated, marked by the continuation of the axial ribs and by a series of closely approximated, low, broad, rounded cords in the umbilicus and on the outer umbilical wall. Aperture broadly oval; peristome

double, the inner exerted and slightly reflected; the outer narrow on the outer and basal lip, expanded into a conspicuous auricle at the posterior angle and on the inner lip posterior to the middle, spreading out as a broad flap, which touches the preceding whorl on the parietal wall and which partly hides the umbilicus. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture behind the peristome directed into the suture.

The type, U.S.N.M. No. 535477, was collected by Doctors Palmer and Bermudez at Cayo Cruz, north of Camagüey, Camagüey Province. It has 3.5 whorls remaining and measures: Length, 9.2 mm.; greater diameter, 7.3 mm.; lesser diameter, 5.4 mm.

OPISTHOSIPHON (CUBITASIPHONA) BERRYI Clapp

Shell elongate-ovate, varying in ground color from flesh color to orange, pale brown and dark brown, usually with a broad subperipheral band which, however, may be wanting. The peristome is flesh colored or pale yellow; the interior varies in intensity of coloration with the exterior. Nuclear whorls 2, small, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by almost vertical or slightly retractively slanting, very closely spaced axial riblets, which vary in strength in the different subspecies. On the early whorls these riblets are distantly spaced, but they become more closely approximated as the shell increases in size, and on the last whorl they are usually about as wide as, or almost as wide as, the spaces that separate them. Some of these riblets become expanded and fused at the summit to form slender cusps, which extend into the suture. These cusps vary considerably in strength in the different subspecies. Base inflated, strongly rounded. Umbilicus varying from almost closed by the reflected outer peristome to entirely open, depending upon the subspecies, marked by the continuation of the axial riblets and by spiral threads. The latter are confined to the umbilical region. Aperture broadly oval; peristome double, the inner moderately exerted and slightly reflected; the outer strongly expanded, always more so on the inner lip than on the outer, that of the inner lip notched either narrowly or broadly, the part posterior to the notch being reflected over the umbilicus. A conspicuous auricle is always present at the posterior angle of the aperture. The outer peristome shows concentric laminations. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture, directed backward into the suture.

This species is restricted to the Cubitas Mountain region of Camagüey Province, where it breaks up into a number of geographic races, which we shall designate as subspecies, and which the following key and descriptions will help in recognition:

KEY TO THE SUBSPECIES OF *OPISTHOSIPHON* (*CUBITASIPHONA*) *BERRYI*

Posterior half of inner lip of the outer peristome flaringly expanded to almost cover the umbilicus.....	<i>viguettense</i>
Posterior half of inner lip of the outer peristome not flaringly expanded but strongly inbent to partly cover the umbilicus.	
Axial ribs moderately strong.....	<i>berryi</i>
Axial ribs very fine.....	<i>transitorium</i>

OPISTHOSIPHON (*CUBITASIPHONA*) *BERRYI* *VIGUETTENSE*, new subspecies

PLATE 17, FIGURE 8

This subspecies is easily differentiated from the others by its larger size and pale color. Bartsch collected a large series of specimens at La Vigüeta, on the north side of the Cubitas Mountains, between Paso de la Guanaja and Los Paredones.

The type, U.S.N.M. No. 535478, has 41 axial ribs on the first of the remaining turns and 132 on the last; it has 4.1 whorls remaining and measures: Length, 14.3 mm.; greater diameter, 9.0 mm.; lesser diameter, 7.2 mm.

OPISTHOSIPHON (*CUBITASIPHONA*) *BERRYI* *BERRYI* Clapp

PLATE 17, FIGURES 9, 10

1919. *Opisthosiphon berryi* CLAPP, Nautilus, vol. 32, p. 86, pl. 7, fig. 14.
 1920. *Opisthosiphon berryi* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.
 1920. *Opisthosiphon* (*Opisthosiphona*) *berryi semiapertus* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.
 1921. *Opisthosiphon* (*Opisthosiphona*) *berryi* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 248, pl. 38, figs. 1-4.
 1921. *Opisthosiphon* (*Opisthosiphona*) *berryi semiapertum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 249-250, in part, pl. 38, figs. 5-8.

This subspecies has a wide distribution. It was described from collections made by Dr. S. S. Berry at Cairije, Cerro de Tuabaquey, at the eastern end of the Cubitas Mountains. Bartsch collected it at Los Corrales de Cangilonés. It appears to range through the rock piles of the southeastern part of the Cubitas Mountain region, including the passes of Vereda de los Burros and de la Guanaja.

Study of a large amount of material now in our collection compels us to fuse *Opisthosiphon* (*Opisthosiphona*) *berryi semiapertum* with the typical subspecies.

In this race the posterior half of the inner lip of the outer peristome, while expanded, does not almost cover the umbilicus, but it is inbent to partly cover it. In this respect it differs from *O. (C.) berryi viguettense*. *Opisthosiphon* (*Cubitasiphona*) *berryi transitorium* has the axial ribs much finer.

In the specimen figured, U.S.N.M. No. 355475, which is one of the original lot, the first whorl shows 70 axial riblets, while the last whorl

has 181. This specimen has a little over 3 whorls remaining and measures: Length, 11.7 mm.; greater diameter, 8.8 mm.; lesser diameter, 6.7 mm. Figure 9 of plate 17 is from a photograph of the type of *O. (O.) b. semiapertum* Torre and Henderson.

OPISTHOSIPHON (CUBITASIPHONA) BERRYI TRANSITORIUM Torre and Henderson

PLATE 17, FIGURE 6

1921. *Opisthosiphon (Opisthosiphona) paredonense transitorium* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 251, pl. 39, figs. 1, 2.

This subspecies was described from the south entrance of Paso de la Guanaja, Cubitas Mountains. Bartsch made an enormous collection of this race in various stations in this pass. It is easily differentiated from typical *O. (C.) berryi berryi* by its smaller size and by its much finer ribbing.

The type, U.S.N.M. No. 314947, has 76 axial ribs on the first of the remaining turns and 188 on the last. It has a little more than 3 whorls remaining and measures: Length, 11.3 mm.; greater diameter, 8.5 mm.; lesser diameter, 6.4 mm.

OPISTHOSIPHON (CUBITASIPHONA) TERSUM Torre and Henderson

PLATE 17, FIGURES 2, 4

1921. *Opisthosiphon (Opisthosiphona) bioscai tersum* TORRE and HENDERSON, Proc. U.S. Nat. Mus., vol. 59, p. 256.

Shell elongate-ovate, flesh colored with a yellowish tinge, marked by interrupted spiral bands of brown, which are almost continuous; the interior of the aperture flesh colored, rayed by the spiral bands; peristome white. Nuclear whorls 2, small, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear axial sculpture. Postnuclear whorls strongly rounded, marked by slender, retractively slanting axial riblets which are distantly spaced on the first of the remaining turns and which gradually become more closely approximated; on the last whorl they are separated by spaces a little narrower than the riblets. In the type 74 of these riblets occur upon the first turn, 112 upon the second, and 184 upon the last; they extend prominently up on the summit where, at more or less regular intervals, several of them become fused to form hollow cusps that crenulate the summit. These cusps are much more conspicuous on the last whorl than on the earlier turns. Suture moderately constricted. Periphery strongly rounded. Base moderately long, openly umbilicated, marked by the continuation of the axial riblets, and by slender spiral threads within the umbilicus, with a few obsolete ones immediately adjacent to it. These spiral threads cause the riblets to become only slightly expanded at their junction. Aperture broadly oval; peristome double, the outer

broadly expanded on the parietal wall, where it is reflected over and appressed to the preceding turn, and on the inner lip this outer peristome is reflected over the umbilicus, almost completely hiding it when viewed squarely; on the basal and outer lip it becomes narrower but it is again expanded into a broad auricle at the posterior angle, where it is rendered irregular by the siphon immediately behind it; inner peristome slightly exerted and slightly expanded. Operculum typically opisthosiphonid.

The type, U.S.N.M. No. 314953, was collected at La Providencia, El Cercado, Sierra de Cubitas, Camagüey Province. It has a little over 3 whorls and measures: Length, 11.0 mm.; greater diameter, 7.2 mm.; lesser diameter, 5.8 mm.

Bartsch also collected this species in Paso de Lesca and at Sitio Afuera, at the south end of Paso de la Escalera, Cubitas Mountains, Camagüey Province.

Figure 2 shows an extreme variant of the species with an enormously developed outer peristome of the inner lip. This is U.S.N.M. No. 355501 and it comes from Paso de los Paredones, and measures: Length, 10.5 mm.; greater diameter, 7.9 mm.; lesser diameter, 6.2 mm

OPISTHOSIPHON (CUBITASIPHONA) APERTUM Torre and Henderson

PLATE 17. FIGURE 1

1920. *Opisthosiphon (Opisthosiphona) apertus* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.
1921. *Opisthosiphon (Opisthosiphona) apertum* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 253, pl. 40, figs. 1, 3.

Shell ovate, thin, flesh colored, horn colored, pale orange, or pale brown, sometimes unicolor, but usually with a broad brown band at the periphery; peristome white; the interior of the aperture varying with the external color. Nuclear whorls 2, small, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by very poorly developed, slightly retractively slanting axial riblets, which are more distantly spaced on the early turns than the later. In the type 42 of these riblets occur upon the first turn, 64 upon the second, 140 upon the third, and 160 upon the last whorl. Some of these riblets extend slightly above the rest at the summit and fuse to form very weak, almost obsolete cusps. Suture strongly constricted. Periphery well rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial riblets, and within the umbilicus by 10 spiral threads. Last whorl solute for almost half a turn. Aperture broadly oval; peristome double, the inner slightly exerted and moderately reflected; the outer, conspicuously expanded on the inner lip and very slightly so on the outer, forming a conspicuous auricle at the posterior angle of the

aperture. Operculum typically opisthosiphonid. Siphon at the posterior angle of the aperture directed backward into the suture.

The type, U.S.N.M. No. 314951, was collected by Torre and Henderson at Paso de Lesca, Sierra de Cubitas, Camagüey Province. It has a little over 3 whorls and measures: Length, 12.2 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.4 mm.

OPISTHOSIPHON (CUBITASIPHONA) DEVIATUM, new species

PLATE 17, FIGURE 7

Shell elongate-ovate, orange-brown with a broad band of brown at the periphery; peristome yellowish white. Nuclear whorls decollated. Postnuclear whorls inflated, well rounded, marked by slightly retractively slanting axial riblets, which are a little more distantly spaced on the early turns than on the later; on the last whorl they are about as wide as the spaces that separate them. Of these riblets, 86 occur upon the first of the remaining turns, 146 upon the second, and 170 upon the last. Some of these riblets fuse at the summit to form minute white cusps. These riblets are of rather irregular development and spacing, and they are best shown on the last turn. Suture strongly constricted. Periphery inflated, well rounded. Base short, openly umbilicated, inflated, well rounded, marked by the continuation of the axial ribs, and within the umbilicus by 14 spiral threads. Last whorl solute for about one-fourth of a turn. Aperture broadly oval; peristome double, the inner moderately exerted; the outer only slightly expanded on the outer lip and but little more so on the inner, forming a conspicuous auricle at the posterior angle. Operculum ? Siphon at the posterior angle directed into the suture.

The type, U.S.N.M. No. 355487, was collected by Torre at Cantera de Montejo, Arroyo Hondo, 3 leagues east of Camagüey. It has 3.5 whorls and measures: Length, 11.2 mm.; greater diameter, 8.2 mm.; lesser diameter, 6.4 mm.

OPISTHOSIPHON (CUBITASIPHONA) PAREDONENSE Torre and Henderson

Shell elongate-ovate, varying in color from flesh color through orange to pale or dark brown or even purplish brown, unicolor, or with a broad peripheral spiral zone of brown. Nuclear whorls 2, small, well rounded, microscopically granulose, showing the beginning of the postnuclear sculpture on the last portion of the last turn. Postnuclear whorls inflated, strongly rounded, marked by slightly retractively slanting axial riblets, which vary in strength and spacing in the different subspecies. Some of these riblets fuse at the summit to form cusps which are variable in strength but which are usually constant in the different subspecies. Suture strongly constricted. Base

inflated, strongly rounded, marked by the continuation of the axial ribs and by numerous spiral lirations on the umbilical wall. The last whorl is solute for a fraction of a turn and has a strong carina behind the posterior angle of the aperture, where the reflexed breathing siphon forms a conspicuous element. Aperture oval; peristome double, the inner peristome slightly exerted; the outer usually a little wider on the parietal wall and the inner lip than on the outer lip, forming a conspicuous auricle at the posterior angle, which is appressed to the breathing siphon. Operculum typically opisthosiphonid.

This species occupies the Cubitas Mountain range of Camagüey Province, where it breaks up into the two following subspecies:

KEY TO THE SUBSPECIES OF *OPISTHOSIPHON (CUBITASIPHONA) PAREDONENSE*

Whorls strongly inflated.....	<i>escalerense</i>
Whorls not strongly inflated.....	<i>paredonense</i>

OPISTHOSIPHON (CUBITASIPHONA) PAREDONENSE ESCALERENSE, new subspecies

PLATE 17, FIGURE 3

This race was collected by Bartsch in large numbers on Paso de la Escalera. It is larger than the typical race and has the whorls much more inflated and the axial ribs on the early turns much less numerous; it is only upon the last whorl that these ribs become decidedly concentrated.

The type, U.S.N.M. No. 535479, has 33 axial ribs on the first of the remaining turns and 175 are on the last. It has almost 4 whorls remaining and measures: Length, 12.5 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.5 mm.

OPISTHOSIPHON (CUBITASIPHONA) PAREDONENSE PAREDONENSE Torre and Henderson

PLATE 17, FIGURE 5

1920. *Opisthosiphon (Opisthosiphona) paredonensis* (Torre and Henderson) HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67, *nomen nudum*.
 1921. *Opisthosiphon (Opisthosiphona) paredonense paredonense* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, p. 251, pl. 38, figs. 9-11.

This race, which is remarkably abundant in the Paso de los Paredones, Cubitas Mountains, is distinguished from *O. (C.) p. escalerense* by its smaller size and by its much less inflated whorls, with the ribs more closely spaced on the second whorl. The cusps at the summit are also much more pronounced.

The type, U.S.N.M. No. 314946, has 62 axial ribs on the first of the remaining turns and 156 on the last; it has a little over 4 whorls remaining and measures: Length, 12.5 mm.; greater diameter, 8.4 mm.; lesser diameter, 6.3 mm.

CYLINDROSIPHONA, new subgenus

Shell subcylindric, with sublamellar axial ribs, which are weakly nodulose. Intercoastal spaces marked by fine axial hairlines. Spiral sculpture absent on spire, base, and umbilicus. Last whorl solute. Operculum typically opisthosiphonid. Siphon free, behind the peristome at the posterior angle of the aperture.

Type: *Opisthosiphon (Cylindrosiphona) bacillum*, new species.

OPISTHOSIPHON (CYLINDROSIPHONA) BACILLUM, new species

Shell small, subcylindric, varying in color from white through straw color to brown, unicolor or banded; peristome faintly yellow. Nuclear whorls a little more than 2, inflated, strongly rounded, of almost uniform diameter, forming a truncated pupoid apex. Postnuclear whorls rather high between summit and suture, moderately rounded, and marked by strong lamellar axial ribs, which become expanded at the summit into rather prominent cusps. Slender, narrow, scalloplike nodules are present on the ribs, which are usually best developed on the early turns. The intercoastal spaces are marked by microscopic axial hairlines. Suture rather strongly constricted. Periphery well rounded. Base short, somewhat inflated, strongly rounded, and marked by the continuation of the axial ribs, which extend into the umbilicus; umbilicus free of spiral sculpture. Last whorl decidedly solute for about one-third of a turn. Aperture broadly oval; peristome double, the inner slightly exserted and reflected; the outer moderately expanded, a little narrower on the parietal wall than on the rest of the aperture, marked by slender, concentric laminae. Operculum typically opisthosiphonid. Siphon free at the posterior angle of the aperture.

The species ranges through parts of Camagüey and Oriente Provinces.

KEY TO THE SUBSPECIES OF OPISTHOSIPHON (CYLINDROSIPHONA) BACILLUM

Axial ribs strongly scalloped.....	garciai
Axial ribs not strongly scalloped.....	bacillum

OPISTHOSIPHON (CYLINDROSIPHONA) BACILLUM GARCIAI, new subspecies

PLATE 19, FIGURE 5

This subspecies was collected by García Castaneda, near Holguín, Oriente Province. It differs from typical *O. (C.) bacillum bacillum* in having the sculpture much more pronounced, the nodulation much stronger, and the color paler. The type has 35 axial ribs on the first of the remaining turns and 48 on the last whorl.

The type, U.S.N.M. No. 535430, has 4.5 whorls remaining and measures: Length, 7.6 mm.; greater diameter, 3.3 mm.; lesser diameter, 2.8 mm.

OPISTHOSIPHON (CYLINDROSIPHONA) BACILLUM BACILLUM, new subspecies**PLATE 19, FIGURE 4**

We have seen this race from El Cacaotal, Sierra de Najaza; Guaicamar; Vereda del Telégrafo; 9 miles east of Cantera de Montejo; Finca de Riverón, Martí; Sierra de Sibanicú and El Zanjón, Sibanicú; all these localities in Camagüey Province. This subspecies differs from *O. (C.) bacillum garciai*, from Oriente Province in having the sculpture less strongly developed, the nodules of the ribs feebler, and the color bands more pronounced. The type has 29 axial ribs on the first of the remaining turns and 32 on the last whorl.

The type, U.S.N.M. No. 535423, comes from El Cacaotal. It has 4.0 whorls remaining and measures: Length, 7.8 mm.; greater diameter, 3.3 mm.; lesser diameter, 3.0 mm.

DALLSIPHONA, new genus

The shells of this monotypic genus have a turbinate shape. They are openly, widely umbilicated, with the surface marked by numerous, fine, closely spaced axial ribs, which are not thickened or gathered into tufts at the summit. The spiral sculpture is confined to the umbilicus. The operculum is typically opisthosiphonid. The siphon is incomplete, i. e., it is connected with the edge of the peristome by a slit.

The genus is known only from the southeastern Cubitas Mountains.

Type: *Dallsiphona dalli* (Torre and Henderson).

DALLSIPHONA DALLI (Torre and Henderson)**PLATE 19, FIGURE 6**

1920. *Opisthosiphon dalli* TORRE and HENDERSON, A new *Opisthosiphon* from Cuba, privately printed, June 25.
1920. *Opisthosiphon (Opisthosiphona) dalli* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68.
1921. *Opisthosiphon (Opisthosiphona) dalli* TORRE and HENDERSON, Proc. U. S. Nat. Mus., vol. 59, pp. 254-255, pl. 40, figs. 2, 8, 9.

Shell turbinate, ranging in color from ivory white or pale brown to pale orange; aperture ivory white. Nuclear whorls 2.7, forming a narrow tip, well rounded, smooth except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Post-nuclear whorls strongly inflated, very strongly rounded, marked by slender, closely spaced, retractively slanting axial threads, of which 102 occur upon the first of the remaining turns in the type, 192 upon the second, and 404 upon the last whorl. These threads are separated by mere impressed lines. Suture well constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial riblets

and within the umbilicus by 13 very fine slender spiral threads. Aperture almost circular; peristome double, the outer broadly expanded on the inner lip, a little less expanded on the parietal wall, where it is adnate to the preceding turn, and least expanded on the outer lip, notched at the posterior angle to form the breathing siphon; inner peristome scarcely at all exerted but broadly reflected. Operculum paucispiral, opisthosiphonid.

The type, U.S.N.M. No. 314941, came from the mouth of Cueva del Circulo, near El Cercado, Sierra de Cubitas, Camagüey Province. It has 3.5 whorls remaining and measures: Length, 12.5 mm.; greater diameter, 11.5 mm.; lesser diameter, 8.8 mm.

The species ranges from the type locality slightly westward into the pass known as Vereda de los Burro.

XENOPOMOIDES, new genus

Shell elongate-conic; axial sculpture consisting of decidedly elevated spinose lamellar ribs, between which less elevated threads are present. Spiral sculpture merely indicated by the regular position of the spines or scallops on the spire and base. Aperture subcircular with double peristome, the outer broadly expanded, notched on the middle of the inner lip, with the part posterior to the notch reflected over and closing the umbilicus. Operculum opisthosiphonid, or like the young of *Xenopoma*. Breathing pore present at the posterior angle of the aperture, a little behind the peristome.

Type: *Xenopomoides delicatulum*, new species.

XENOPOMOIDES DELICATULUM, new species

PLATE 19, FIGURE 1

Shell elongate-conic, thin, milk white. Nuclear whorls 2, decidedly inflated, strongly rounded, microscopically granulose, forming a large mammillated apex, which projects over the preceding turn. Post-nuclear whorls strongly rounded, marked by axial ribs, which are of two series, one decidedly lamellar and distantly, not regularly spaced; the other series more numerous, between the lamellar ribs consisting of elements a little higher than threads, yet not quite lamellar. The elevated ribs are provided at regular intervals with scalloped, flattened, denticle-like projections, which are not hollow; of these, 5 occur between the summit and suture and 3 on the base between the edge of the closed umbilicus and the periphery. Suture strongly constricted. Base short, strongly rounded. Aperture subcircular; peristome double, the inner slightly exerted and slightly reflected; the outer very broadly expanded and notched on the edge of the inner lip, the portion posterior to the notch being reflected over the um-

bilicus, which it completely closes, and over the parietal wall. The outer peristome is marked by concentric lamellae. Operculum opisthosiphonid, that is, it bears numerous, closely spaced, decidedly elevated, retractively slanting lamellae, which do not quite cover the entire whorls but which leave the spaces free between adjacent whorls. The outer and inner edges of these riblets are fused into a slender lamella. The structure really more closely resembles early stages of *Xenopoma* than *Opisthosiphon*. There is a breathing puncture at the posterior angle of the aperture a little behind the peristome.

The type, U.S.N.M. No. 535537, was collected by Dr. Charles T. Ramsden at Florida Blanca, Oriente Province. It has 4.6 whorls remaining and measures: Length, 9.5 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.3 mm.

Genus RHYTIDOTHYRA Henderson and Bartsch

1920. *Rhytidothyra* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 65.

Shell elongate-ovate, marked by axial ribs and by spiral threads. A breathing pore at the posterior angle of the aperture, a short distance within the peristome, communicates with a slender tube following the posterior angle of the aperture on the inside for three or more whorls, where it in turn communicates with a slender cleft in the wall of the hollow axis, through which breathing may take place through the narrow puncture at the decollated tip. The operculum consists of many strongly raised, retractively curved lamellar ribs, which extend completely across the turns. These lamellar ribs are high at their inner edge, from which they pass down in a gentle curve, rising again to their highest altitude at their outer border, where they become fused into a spiral lamella, which projects almost as far as the basal chondroid plate. The lateral margin of the operculum is strongly channeled.

Type: *Rhytidothyra bilabiata* (Orbigny).

RHYTIDOTHYRA BILABIATA (Orbigny)

Shell broadly conic, varying from comparatively large to moderately small; ranging in color from ashy gray to reddish or even through pale brown to rather bright red; never banded. The peristome varies from white to pale orange; the inside of the aperture has the same range of color variation. Nuclear whorls about 2, well rounded, smooth, forming a small apex, which appears slightly truncated. Postnuclear whorls strongly rounded, slightly shouldered at the summit, marked by retractively slanting, slightly wavy, sublamellar, closely spaced axial ribs, which are much more strongly developed and

broadly expanded at the summit. These riblets are more closely approximated at irregular intervals, which condition gives a somewhat varicial appearance to the shell. The spiral sculpture consists of spiral threads, which vary considerably in strength in the different races; in some races they are scarcely apparent, while in others they are quite conspicuous. The junctions of the axial riblets and spiral threads do not form conspicuous nodules, but the spiral threads render the axial riblets wavy. Suture strongly constricted. Periphery of the last whorl inflated, well rounded. Base short, inflated, well rounded, openly umbilicated, marked by the continuations of the axial riblets, which here become very much intensified, and which are almost broken up into squamae by the spiral sculpture. This condition is particularly pronounced immediately behind the aperture, where each lamella terminates in a series of scallops. This character is also a variable one, finding different expressions in the different races. The last whorl is disjunct for a varying distance, depending upon the subspecies. Aperture subcircular; peristome double, the outer moderately, broadly expanded, a little wider on the parietal wall and the inner lip than on the rest of the shell. In some of the races the parietal outer peristome is appressed to the preceding turns; in others it remains disjunct. Inner peristome stronger exerted and slightly reflected. A breathing pore opens on the inside of the parietal wall at some little distance behind the aperture, near the posterior angle of the aperture. This pore communicates with a tube, which is located in the posterior angle and which extends backward for more than 3 whorls. It then communicates by a slender cleft with the hollow axis, through which breathing is evidently effected when the operculum is closed. Operculum consists of many strongly raised, retractively curved lamellar ribs, which extend completely across the turns. These lamellar ribs are high at their inner edge, from which they pass down in a gentle curve, rising again to the highest altitude at their outer border, where they become fused into the spiral lamellae, which project almost as far as the basal chondroid plate at the edge of the operculum; the lateral margin of the operculum is strongly channeled.

This species is widely distributed through the Province of Pinar del Rio, occurring almost on every exposed lump of limestone from Guane eastward to Rangel and Rio Santa Cruz.

The peculiar development of the breathing apparatus defines a very distinct group, which we recognize as a single species. This species breaks up into a series of geographic races, upon which we shall bestow subspecific rank.

KEY TO THE SUBSPECIES OF RHYTIDOTHYRA BILABIATA

Entire shell bright rose colored.....	rosea
Entire shell not bright rose colored.	
Early whorls only, bright rose colored.	
Later whorls with a rosy flush.....	rosacea
Later whorls without a rosy flush.	
Peristome white.....	bilabiata
Peristome buff.....	aurantiaca
Early whorls white.	
Shell small.....	nana
Shell not small.....	straminea

RHYTIDOTHYRA BILABIATA ROSEA, new subspecies

PLATE 18, FIGURE 2

This subspecies ranges from La Mina westward to the Sierra de Ancon, where we have seen it from the Hoyo de Magdalena, in the Costanera de San Vicente, then southward through the south side of this range to the Sierra del Infierno.

It is characterized by a bright rose color. It also has the axial ribs less expanded at the edge and a little more distantly spaced than the other races, and the spiral sculpture is emphasized, the combination of the two forming a screenlike pattern.

The type, U.S.N.M. No. 535505, has 5.2 whorls remaining and measures: Length, 18.6 mm.; greater diameter, 12.2 mm.; lesser diameter, 9.3 mm.

RHYTIDOTHYRA BILABIATA ROSACEA, new subspecies

PLATE 18, FIGURE 5

This subspecies centers about the region of Viñales. We have it from the Sierra de Viñales, the Chorrera, the mogotes from Laguna de Piedras, extending from the Mogote Puertecitas to Mogote de la Rinconada. We also refer here, with some doubt, specimens from Cayos de San Felipe.

In this subspecies we have rosy early whorls, and the rest of the turns are washed with pale rose color. The peristome is white.

The type, U.S.N.M. No. 355142, comes from the Puerta del Ancon. It has a little more than 4 whorls remaining and measures: Length, 18.2 mm.; greater diameter, 11.9 mm.; lesser diameter, 9.7 mm.

The animal of this subspecies was described by Bartsch, from specimens collected by him on the Chorrera, June 22, 1928, as follows: Body ash gray, with numerous fine, smoky flesh-colored dots. Tentacles bright orange, with pale red base. Foot short, deeply cleft in the median line, smoky gray. The locomotion of the two sides is alternate.

RHYTIDOTHYRA BILABIATA BILABIATA (Orbigny)

PLATE 18, FIGURE 6

1842. *Cyclostoma bilabiata* ORBIGNY, in Sagra's Histoire physique, politique et naturelle de l'île de Cuba, vol. 1, pp. 258-259, pl. 22, figs. 3-5, 8, 8'.
1849. *Cyclostoma salebrosum* MORELET, Testacea novissima insulae Cubana et Americae Centralis, p. 23.
1850. *Cyclostoma dorbignyanum* PETIT, Journ. Conchyl., vol. 1, p. 46.
1850. *Choanopoma? bilabiatum* GRAY, Nomenclature of molluscan animals and shells in the collection of the British Museum, p. 52.
1852. *Cistula? bilabiata* PFEIFFER, Monographia pneumonopomorum viventium, vol. 1, pp. 271-272, in part.
1856. *Ctenopoma bilabiatum* PFEIFFER, Malakozool. Blätter, vol. 3, p. 59.
1863. *Chondropoma bilabiatum* REEVE, Conchologia iconica, No. 7.
1890. *Ctenopoma bilabiatum* CROSSE, Journ. Conchyl., vol. 38, p. 276.
1920. *Rhytidothyra bilabiata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 65.

The typical subspecies was described from Pan de Guajaibón. It is known also from Hato Caimito, just west of Pan de Guajaibón, and from Sierra Chica, to the south. It has been found also at Cacarajicara, to the northeast of Guajaibón, and it extends southeast of Guajaibón to Rangel and the Rio Santa Cruz.

From a nomenclatorial standpoint this race has met with considerable difficulty, as is shown in our synonymy. It is distinguished by being rather large, in having the apex bright rose-colored, with the rest of the shell white. The last whorl is solute. The axial ribs are rather closely spaced and are rendered vertebrated by the spiral threads. On the early whorls the spiral sculpture is considerably more pronounced than on the last. In strength and disposition of the axial ribs this subspecies resembles *R. bilabiata aurantiaca*, from which it is readily distinguished by its white peristome.

The specimen described and figured, U.S.N.M. No. 355155, was collected at Sagua on the west side of Pan de Guajaibón. It has a little more than 4 whorls remaining and measures: Length, 14.9 mm.; greater diameter, 9.7 mm.; lesser diameter, 8.0 mm.

RHYTIDOTHYRA BILABIATA AUBANTIACA, new subspecies

PLATE 18, FIGURE 4

This race has a rather extensive distribution. We have seen specimens from Sierra de Guane, Mendoza (Paso Real), Puerta de la Muralla, Sierra de los Acostas, El Francisco, Sierra de San Carlos or Luis Lazo, Sumidero, Isabel Maria, the mogotes east of Cabezas, and Pan de Azucar. It therefore appears to cover the entire western part of the Organos Mountains and the limestone blocks lying off that region.

The subspecies is characterized by having a bright rose-colored tip, with the rest of the shell faintly flushed with rose. The peristome and the interior of the aperture are buff.

The type, U.S.N.M. No. 355127, comes from Sierra de Guane. It has a little more than 4 whorls remaining and measures: Length, 17.0 mm.; greater diameter, 11.4 mm.; lesser diameter, 8.9 mm.

The animal of this subspecies was collected on the Sierra de los Acostas July 6, 1928, by Bartsch. He describes it as having the upper parts pale buff, marbled with small brownish streaks. The sides of the body are darker than the dorsum. Tentacles pale buff. Sole of the foot short, flesh colored with smoky suffusion, deeply, medially cleft, the motion being alternate on the two sides.

RHYTIDOTHYRA BILABIATA NANA, new subspecies

PLATE 18, FIGURE 1

This subspecies occupies the various limestone blocks surrounding Kilometer 14 between Pinar del Rio and Viñales. It is a small, completely white race; even the peristome is white. In the axial ribbing it resembles *R. bilabiata straminea*, from which the color will distinguish it. The spiral sculpture in *nana* is a little stronger, also.

The type, U.S.N.M. No. 355136, comes from the mogote on the north side of the road. It has a little more than 4 whorls remaining and measures: Length, 15.0 mm.; greater diameter, 9.2 mm.; lesser diameter, 7.5 mm.

RHYTIDOTHYRA BILABIATA STRAMINEA, new subspecies

PLATE 18, FIGURE 3

This subspecies ranges through the isolated blocks of limestone known as Hoyo del Guamá, Las Cuevitas, and Las Lagunitas. It is a medium-sized race, with the early whorls white and with the rest of the shell straw-colored. The axial ribs are sublamellar and expanded at the free margin. The spiral sculpture is comparatively reduced so that it is not as conspicuous as in the other races.

The type, U.S.N.M. No. 169927, comes from Hoyo del Guamá. It has 3.5 whorls remaining and measures: Length, 15.1 mm.; greater diameter, 10.2 mm.; lesser diameter, 8.2 mm.

Genus XENOPOMA Crosse

1890. *Xenopoma* CROSSE, Journ. Conchyl., vol. 38, p. 282.

Shell elongate-conic, with the last part of the last whorl detached and deflected considerably below the preceding turn. The sculpture consists of widely spaced axial ribs, which bear strong, hollow, cusplike tubercles at their intersections with the obsolete spiral cords. In addition to this, fine, wavy axial threads occur between the cusped

ribs. Peristome reflected, widely expanded, and somewhat fluted. Operculum marked by retractively curved ribs, which do not extend across the entire width of the whorls. The inner border of these ribs is fused to form a lamella, which is a little higher than the ribs. The outer border of the ribs become fused to form an enormously developed lamella in the last turn, which is reflected inward, domelike, over the operculum which it almost completely covers. This reflected lamella bears fine corrugations on its surface. The center of the operculum is decidedly concave.

Type: *Xenopoma hystrix* ([Wright] Pfeiffer).

KEY TO THE SPECIES OF XENOPOMA

Spines small.....	<i>humboldtianum</i>
Spines large.	
Outer peristome broadly expanded on the parietal wall.....	<i>aguayoi</i>
Outer peristome not broadly expanded on the parietal wall.	
Umbilical wall with well developed spiral zones of spines..	<i>hendersoni</i>
Umbilical wall without well developed spiral zones of spines.	
Spines between summit and umbilicus, 4.....	<i>hystrix</i>
Spines between summit and umbilicus, 9.....	<i>spinosissimum</i>

XENOPOMA HUMBERTIANUM (Pfeiffer)

PLATE 19, FIGURE 8

1867. *Choanopoma humboldtianum* PFEIFFER, Malakozool. Blätter, vol. 14, pp. 150-151.
1898. *Choanopoma (Blaesospira) humboldtianum* KOBELT and MÖLLENDORFF, Nachr. Deutsch. Malak. Ges., vol. 30, p. 183.
1920. *Xenopoma humboldtiana* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68.

Shell broadly elongate-conic, flesh colored. Nuclear whorls decol-
lated in all our specimens. Postnuclear whorls inflated, strongly
rounded, marked by slender, raised, spinulose axial lamellae, between
which from 3 to 7 finer axial threads are present. Of the axial lamellae
20 are present in the specimen figured on the first of the remaining
turns, 30 on the second, 44 on the third, and 42 on the fourth. These
lamellae bear rather fine, low, hollow spines, of which 3 are present on
the first and second, and 5 are upon the remaining turns between the
summit and the suture. Suture strongly constricted. Periphery in-
flated, strongly rounded. Base short, inflated, strongly rounded, and
marked by the continuation of the axial sculpture and by 4 slender
denticles on each lamella, the fourth marking the outer boundary of
the umbilical wall being the strongest, while within the umbilicus
there are 11 spiral threads which, at their junction with the axial
lamellae, form slender nodules. The last whorl is solute for a little
more than half a turn. Aperture subcircular; peristome double, the
inner slightly exerted; the outer broadly expanded on the outer and

basal lip, less so on the inner and parietal wall. Operculum paucispiral, with the nucleus almost subcentral, each whorl marked by raised calcarous lamellae as in young *Xenopoma*, but here the outer surface of the lamellae is not strongly developed and arched over as it is in the other *Xenopomas*.

There are 4 specimens before us, U.S.N.M. No. 493394, received from Dr. C. Ramsden, collected on Mogote de Santa Ana, Oriente Province. The one described and figured has a little over 4 whorls and measures: Length, 10.0 mm.; greater diameter, 7.2 mm.; lesser diameter, 5.2 mm.

XENOPOMA AGUAYOI, new species

PLATE 19, FIGURE 7

Shell very large, elongate-conic, pale yellow. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a slender, rather elongated apex. The last portion of the last nuclear turn shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly rounded, marked alternately by decidedly spinose axial lamellae and by finer axial threads between these, the latter varying in number from 4 to 10. The second and third turns have 19 of the strong lamellae, while 22 are present on the fourth, 23 on the fifth, 24 on the sixth, and 25 on the last postnuclear whorl. On the first turn the strong spiral sculpture is poorly differentiated. The spines on the lamellae form exceedingly large cusps, which are hollow. These cusps are not well differentiated on the first and second postnuclear turns; on the third, 2 strong cusps and indications of lesser ones are present; on the fifth there is a strong median cusp with 2 less strong anterior and one posterior to it; on the sixth whorl there is a strong median cusp with 2 posterior and anterior to it. These become intensified on the first whorl; on the last whorl there are 4 strong cusps and a slender, auriclelike element at the summit, and sometimes a more slender denticle between the one at the summit and the first strong cusp. Between the periphery and the umbilicus two more cusps are present. The umbilical wall also shows some indication of fine spines, although here they are almost obsolete. The last whorl is solute and deflected for about half a turn. Aperture subcircular; peristome double, the inner slightly exerted and reflected; the outer very broadly expanded and of almost the same width all around, marked by concentric laminae. Operculum typically xenopomid.

The type, U.S.N.M. No. 535541, was collected by Dr. Aguayo at Loma de la Cantera, Miranda, Oriente Province. It is a complete specimen having 9.6 whorls and measuring: Length, 18.2 mm.; greater diameter, 10.1 mm.; lesser diameter, 6.0 mm.

This species is easily distinguished from all the others by having the peristome broadly expanded on the parietal wall.

XENOPOMA HENDERSONI, new species

PLATE 19, FIGURE 3

Shell elongate-conic, flesh colored with a pinkish tinge, the tip and the peristome white. Nuclear whorls 2, forming a conspicuous mammillated apex, with the whorls inflated and microscopically granulose, and the last portion of the last turn showing the beginning of the post-nuclear sculpture. Postnuclear whorls strongly rounded, marked by strongly raised slender spinose axial lamellae, between which 4 to 8 finer axial threads are present. Of these lamellae, 24 occur on the first turn of the type, 22 on the second and third, 24 on the fourth, 26 on the fifth, and 32 on the last whorl. The lamellae on the first turn bear no spines, on the second there are 2, on the third and fourth 3, on the fifth 4, and on the sixth 6 between the summit and the suture. Suture strongly constricted. Periphery strongly rounded. Base well rounded, openly umbilicated, marked by the continuation of both the strong and the weak axial sculpture. The lamellae bear 3 slender spines. Within the umbilicus the wall is marked by the continuation of the axial threads and by much enfeebled lamellae. These are crossed by 9 spiral threads, which render their junctions with the axial lamellae minutely spinose. The last whorl is solute for a little more than half a turn. Aperture subcircular; peristome double, the inner slightly exerted; the outer broadly expanded on the outer and basal lip, less so on the inner and parietal, fluted and slightly digitated at the external margin. Operculum typically xenopomid.

The type, U.S.N.M. No. 493390, was collected by Mr. Henderson at Farallon de Nipe, Oriente Province. It has 8.2 whorls remaining and measures: Length, 14.0 mm.; greater diameter, 7.6 mm.; lesser diameter, 6.1 mm.

This species is easily distinguished from the other members by the presence of fine spines on the umbilical wall.

XENOPOMA HYSTRIX ([Wright] Pfeiffer)

PLATE 19, FIGURE 2

- 1861. *Cyclostoma pterostomum* [Gundlach] POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, p. 405, *nomen nudum*.
- 1862. *Choanopoma hystrix* [Wright] PFEIFFER, Malakozool. Blätter, vol. 8, pp. 221–222.
- 1890. *Xenopoma hystrix* CROSSE, Journ. Conchyl., vol. 38, pp. 283–284, pl. 5, fig. 2.
- 1920. *Xenopoma hystrix* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 68.

Shell very elongate-conic, flesh colored. Nuclear whorls a little more than 2, well rounded, microscopically granulose, forming a conspicuous mammillated apex with the last portion of the last turn

showing the beginning of the postnuclear sculpture. Postnuclear whorls strongly rounded, marked by axial lamellae, which bear hollow spines; between these axial lamellae are finer axial threads. On the first postnuclear whorl the axial sculpture consists of 40 slender riblets, while on the succeeding two turns 16 lamellae are present on each; on the fourth whorl there are 18, on the fifth 20, and on the last 24. Two spines are present on the spire of all the turns but the last. On the last an additional spine makes its appearance between the summit and the first strong spine. On the middle of the base there is another spine on the continuation of the lamellae. The last whorl is solute for about a whole turn, and broadly deflected. The inside of the umbilical wall is marked by fine axial threads, continuing the finer sculpture; the coarser lamellae are here much reduced. Aperture subcircular; peristome double, the inner slightly exserted; the outer broadly expanded, slightly digitate, and fluted on the outer lip. Operculum typically xenopomid.

U.S.N.M. No. 10990 contains 4 specimens from the type locality, Cayo del Rey, Oriente Province, collected by C. Wright. One of these is a perfect specimen, which we have described and figured. It has 8.2 whorls and measures: Length, 14.3 mm.; greater diameter, 5.8 mm.; lesser diameter, 5.2 mm.

This species differs from *X. hendersoni* and *X. spinosissimum* by having only three spines on the lamellae of the last whorl.

XENOPOMA SPINOSISSIMUM, new species

PLATE 19, FIGURE 9

Shell broadly elongate-conic, pinkish flesh colored with the peristome white. Nuclear whorls 2, forming a conspicuous apex, the inflated microscopically granulose whorls of which form a decidedly mammillated apex. The last portion of the last nuclear turn shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly rounded, marked by slender, raised, spinose axial lamellae, between which 6, 8, or even more slender axial threads are present. On the first whorl there are 34 slender axial riblets, on the second 26, on the third 20, on the fourth 22, on the fifth 24, and on the sixth 26. These lamellae bear two spines on the first, second, and third turns; on the fourth there are 4, on the fifth 5, and on the last 7 between the summit and the suture. These spines are very long, slender, and hollow. Suture strongly constricted. Base short, strongly rounded, marked on the ribs by 2 strong spines and a third that is less strong. Within the umbilicus there are 5 slender spiral threads. There is little differentiation within the umbilicus between the strong lamellae and the finer sculpture. The last whorl is solute and deflected for a little more than half a turn. Aperture subcircular; peristome double,

broadly expanded, the inner slightly exerted; the outer slightly fluted on the outer edge. Operculum typically xenopomid.

The type, U.S.N.M. No. 493388, was collected by Mr. Henderson at Farallon de Canapú, Cayo del Rey, Oriente Province. It has 7.5 whorls remaining and measures: Length, 11.5 mm.; greater diameter, 6.3 mm.; lesser diameter, 5.5 mm.

This species is readily distinguished from *X. hystrix* by its large number of spiral threads and by its larger number of spines, and from *X. hendersoni* by lacking the fine spines on the umbilical wall.

Genus PARACHONDRIA Dall

1905. *Parachondria* DALL, Proc. Malac. Soc. London, vol. 6, p. 209.

Shell ranging in shape from elongate-ovate to elongate-conic, marked by axial ribs only, or by axial ribs and spiral threads, which are confined to the umbilicus, or by axial and spiral threads on spire and base, or slender axial lamellae and subobsolete spiral threads, which give to the axial sculpture an articulate appearance. No breathing device is present. The operculum has the inner portion of its turns covered by a calcareous deposit, which consists of numerous low, retractively curved, fused riblets, which are not fused into a raised lamella at their outer edge, nor does the calcareous deposit extend to the edge of the chondroid basal plate. There is thus left a narrow channel, in the bottom of which the chondroid plate may be seen at the outer edge of each whorl.

Type: *Parachondria fascia* Wood.

The genus is represented by the subgenera *Parachondria* and *Parachondrops*. In the Cuban species the *Parachondria* characters of the operculum are very poorly developed; they are not nearly as strong as those in the Jamaican species.

KEY TO THE CUBAN SUBGENERA OF PARACHONDRIA

Axial and spiral sculpture strong.....	Parachondria
Axial and spiral sculpture not strong.	
Axial ribs narrow, rendered articulate by the spiral sculpture.....	Parachondrops

Subgenus PARACHONDRIA Dall

1905. *Parachondria* DALL, Proc. Malac. Soc. London, vol. 6, p. 209.

Shell elongate-conic, marked by strong axial and spiral threads on spire and base. Operculum typical parachondroid.

Type: *Parachondria (Parachondria) fascia* (Wood).

KEY TO THE SPECIES OF THE SUBGENUS PARACHONDRIA

Last whorl adnate.....	texta
Last whorl solute.....	abnata

PARACHONDRIA (PARACHONDRIA) TEXTA ([Gundlach] Pfeiffer)

Shell large, elongate-conic, pale horn-color with very faint interrupted spiral bands of brown. The dots or spots composing these bands are arranged in both axial and spiral series. Nuclear whorls almost 2, inflated, well rounded, microscopically granulose. Post-nuclear whorls well rounded, marked by slender, well-rounded axial ribs, which are strongly elevated and gathered into tufts at the summit. In addition to the axial sculpture the whorls are marked by slender, spiral threads, which render the axial ribs nodulose, the nodules being oval with their long axis coinciding with the axial sculpture. Suture moderately well constricted. Periphery well rounded. Base moderately long, narrowly, openly umbilicated, marked by the continuation of the axial riblets and by spiral threads between the periphery and the outer angle of the umbilicus. These threads render the axial riblets nodulose, and they are a little stronger than those on the spire. The outside of the umbilical wall is also marked by slender spiral threads. The last whorl may be slightly solute or the outer peristome may be adnate to the preceding turn. Aperture broadly oval; peristome double, the outer broadly flaringly expanded; the inner slightly expanded and appressed to the outer. Operculum paucispiral with a chondroid basal plate with a heavy calcareous deposit, which forms radiatingly curved, low ridges that do not quite reach to the periphery of the turns. This operculum stands midway between typical *Chondropoma* and *Parachondria*. The species is known only from Oriente Province. We recognize the following subspecies:

KEY TO THE SUBSPECIES OF PARACHONDRIA (PARACHONDRIA) TEXTA

Shell pale and inconspicuously spotted.....	texta
Shell not pale and rather conspicuously spotted.	
Axial ribs of uniform strength.....	portillensis
Axial ribs not of uniform strength.....	booneae

PARACHONDRIA (PARACHONDRIA) TEXTA TEXTA ([Gundlach] Pfeiffer)

PLATE 20, FIGURE 7

1858. *Cyclostoma textum* (Gundlach) PFEIFFER, Malakozool. Blätter, vol. 5, p. 192.
 1861. *Chondropoma textum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.
 1920. *Chondropoma* (*Chondropomorus*) *textum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 61.

This typical subspecies was collected by Gundlach at El Morro, at the entrance to the port of Santiago, Oriente. It is larger than the other races, paler, with the brown spots almost obsolete, but their indication shows that here, also, they are in axial and spiral series. They are rather distantly spaced. The axial riblets are quite slender, and

their spacing is a little more approximated than that of the spiral threads, which are of about equal strength.

Gundlach says that he found specimens of this race on trees close to the ground and among sprouts and that the animal is pale brown with an olivaceous tint. The tentacles are white at their base and tip and they are ochraceous-orange in the middle.

A cotype, U.S.N.M. No. 493347, has 4.5 whorls remaining and measures: Length, 17.3 mm.; greater diameter, 8.7 mm.; lesser diameter, 7.0 mm.

PARACHONDRIA (PARACHONDRIA) TEXTA PORTILLENIS, new subspecies

PLATE 20, FIGURE 9

This race, which Bartsch collected at Puerto del Portillo, east of Ensenada de Mora, is dark, like *P. (P.) texta booneae*, but the brown markings are a little less pronounced, and the whorls are much more inflated and gibbose and average considerably larger.

The type, U.S.N.M. No. 391398, has 5.0 whorls remaining and measures: Length, 16.5 mm.; greater diameter, 8.7 mm.; lesser diameter, 7.4 mm.

PARACHONDRIA (PARACHONDRIA) TEXTA BOONEAE (Welch)

PLATE 20, FIGURE 8

1934. *Chondropoma (Chondropomorus) textum booneae* WELCH, Nautilus, vol. 47, pp. 107-108, pl. 11, fig. 4.

This race, which was collected by Pilsbry in a ravine east of La Vigia, Ensenada de Mora, is smaller than the typical race and is much darker in color. The interrupted spiral bands are almost continuous, and the axial arrangement, while still indicated, is less pronounced.

The type, U.S.N.M. No. 535329, has 4.5 whorls remaining and measures: Length, 15.0 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.5 mm.

PARACHONDRIA (PARACHONDRIA) ABNATA ([Gundlach] Pfeiffer)

PLATE 20, FIGURE 6

1858. *Cyclostoma abnatum* [Gundlach] PFEIFFER, Malakazool. Blätter, vol. 5' p. 191.

1861. *Chondropoma abnatum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1920. *Chondropoma (Chondropomorus) abnatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 61.

Shell elongate-conic, flesh colored, with interrupted pale brown spiral bands. The dots composing these bands are arranged in both axial and spiral series. Nuclear whorls almost 2, forming a very blunt, inflated apex, all but the last portion microscopically granulose, the

last part showing the beginning of fine axial threads. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, slender, sublamellar axial riblets, which are of irregular strength and spacing. These riblets are gathered together into tufts at the summit. The spaces separating these riblets vary from as wide as the riblets to four times their width. In addition to the axial riblets, the whorls are marked by spiral threads, which, while slender, are nevertheless rather strongly elevated. These spiral threads render the axial riblets conspicuously tuberculated. The spaces enclosed between the axial riblets and the spiral threads are more or less square or rectangular pits, depending upon the approximations of the riblets. Suture very strongly constricted. Periphery of the last whorl strongly rounded. Base short, inflated, narrowly, openly umbilicated, strongly rounded, marked by the continuations of the axial riblets and by spiral threads, which are a little stronger than those on the spire. These threads also render the axial riblets conspicuously nodulose. There are 5 of the spiral threads on the base between the periphery and the edge of the umbilicus. On the inner umbilical wall 5 additional threads are present; these decrease in size from without, inward. The last whorl is solute for about one-twentieth of a turn. Aperture large, oval; peristome double, the outer decidedly expanded and reflected, slightly channeled at the anterior angle, and somewhat auriculate at the posterior angle, of almost equal width around the outer lip, slightly broader at the junction of the basal and inner lip; on the parietal wall the peristome is of about half the width of that of the outer lip and is separated from the preceding turn by a gap as wide as or wider than the width of the peristome; inner peristome moderately elevated, slightly expanded and reflected. Operculum paucispiral, with the nucleus halfway between subcentral and marginal; the outside covered with a fine granular deposit and the curved parachondroid ridges.

Gundlach cites Aguadores, near Santiago, as the type locality, where he collected it "among rubbish and below rocks." He speaks of the animal as follows: "Animal pale, brownish white with a rose colored tinge. The antennae of the same color but the thickened apex and the snout pale brownish. The head is marked with dark spots. In other examples the color is soiled white, while the head has a Turk blue sheen. The tentacles are also of this color, but the apex and the snout are brownish; the head is spotted with small dots." We have also seen specimens from Ciudadmar (El Morro), and Siboney.

The specimen described and figured, U.S.N.M. No. 104497, is probably from the type locality. It has 3.5 whorls remaining and measures: Length, 10.6 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.5 mm.

Subgenus PARACHONDROPS Henderson and Bartsch

1920. *Parachondrops* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 66-67.

Shell elongate-conic. Nuclear whorls about 2, the first smooth, except for microscopic granules; the second also very strongly rounded and marked by fine, hairlike, retractively curved axial riblets, which are relatively more closely spaced than the axial ribs on the post-nuclear whorls. We have here an acceleration of the postnuclear sculpture extending over half of the nuclear turns. The axial sculpture of the postnuclear whorls consists of slender sublamellar riblets, which are rendered wavy or articulate by the ill-defined spiral sculpture. Operculum typically parachondroid.

Type: *Parachondria* (*Parachondrops*) *campbelli* (C. B. Adams).

KEY TO THE SPECIES OF THE SUBGENUS PARACHONDROPS

Decollated shell more than 13 mm. long.

Outer peristome narrow, of the same width all around..... *wrighti*

Outer peristome not narrow or of the same width all around.

Sculpture strong.

Whorls inflated, rotund..... *erecta*

Whorls not inflated, well rounded..... *lurida*

Sculpture feeble..... *abtiana*

Decollated shell not more than 11 mm. long.

Last whorl decidedly solute..... *daudinoti*

Last whorl adnate or almost so.

Basal spiral threads rather strong..... *chordata*

Basal spiral threads obsolete..... *nigricula*

PARACHONDRIA (PARACHONDROPS) WRIGHTI (Pfeiffer)

PLATE 20, FIGURE 5

1862. *Tudora wrighti* PFEIFFER, Malakozool. Blätter, vol. 9, p. 4, pl. 1, figs. 4, 5.

Shell elongate-conic, thin, semitranslucent. Nuclear whorls decollated. Postnuclear whorls only moderately rounded, marked by low, retractively curved, slightly wavy axial riblets, which become almost obsolete on the last turn. Some of these riblets become expanded and form hollow tufts at the summit. The spiral sculpture is just sufficiently indicated to render the axial riblets articulate, but scarcely noticeable on the last whorl. Suture moderately constricted. Periphery inflated, strongly rounded. Base rather short, inflated, strongly rounded, openly umbilicated, and marked by the feeble continuation of the axial ribs and, near the umbilicus, by a few weak spiral threads. Aperture oval; peristome double, the outer very slightly expanded, slightly auriculate at the posterior angle, very narrow, scarcely projecting beyond the inner, which is also reflected on the outer lip and only a little so on the

columellar and parietal wall. There is a slight space between the outer peristome and the preceding turn.

The specimen described and figured, U.S.N.M. No. 367773, was collected by Wright at Hermitaño, between Demajagua and Guantánamo. It has 4.0 whorls remaining and measures: Length, 14.8 mm.; greater diameter, 7.2 mm.; lesser diameter, 6.2 mm. The thin shell and the obsolete sculpture will easily distinguish this species from all the other *Parachondrops*.

PARACHONDRIA (PARACHONDROPS) ERECTA ([Gundlach] Pfeiffer)

Shell elongate-conic, varying in color from flesh color to pale wax yellow. The peristome may be white or yellowish. In addition to this the shell is marked by interrupted spiral bands of brown, which vary from strong to merely indicated. Nuclear whorls 1.5, forming a blunt apex, the first half white, well rounded, smooth, except for microscopic granules. The next turn is inflated, strongly rounded, and marked by fine, hairlike, retractively slanting axial riblets, which are about half as wide as the spaces that separate them and are much closer spaced than the axial riblets of the postnuclear turns. Post-nuclear whorls well rounded, marked by slender axial riblets, which vary considerably in strength, spacing, and regularity in the various subspecies. Some of these riblets are expanded at the summit, or several of them may be fused at the summit to form large, hollow cusps. The spiral threads are even more slender than the axial riblets which are rendered slightly wavy, that is, articulate, by the spiral threads. Suture well constricted. Periphery well rounded. Base moderately long, well rounded, with a moderately wide-open umbilicus, marked by the same type of sculpture as that characterizing the spire. Within the umbilicus the spiral sculpture becomes much intensified, forming rather strong cords, while the axial riblets become somewhat reduced. The last whorl is nearly always very slightly solute behind the aperture. Aperture broadly ovate; peristome double, the outer moderately expanded, somewhat auriculate at the posterior angle, and a little wider on the columellar margin than on the outer lip. The peristome may touch the preceding whorl or it may leave a slight curve between it and the preceding turn. The outer peristome is marked by feeble lines of growth; the inner peristome is slightly expanded and almost appressed to the outer. Operculum thin, corneous, paucispiral, with excentric nucleus and a heavy deposit of calcareous material, which is more or less arranged in concentric ridges, feebly indicating the parachondroid sculpture.

The species is restricted to Oriente Province and breaks up into a series of races, four of which we recognize here as distinct subspecies. The following key will help to differentiate these:

KEY TO THE SUBSPECIES OF PARACHONDRIA (PARACHONDROPS) ERECTA

Spiral sculpture on last whorl strong.

Interrupted color bands strong.

Axial riblets closely spaced..... *mayensis*

Axial riblets distantly spaced..... *ramonensis*

Interrupted color bands feeble..... *erecta*

Spiral sculpture on last whorl feeble..... *turquinensis*

PARACHONDRIA (PARACHONDROPS) ERECTA MAYENSIS, new subspecies

PLATE 20, FIGURE 1

This race, which was collected by Dr. Ramsden at Isabelita plantation, La Maya, Oriente, has the axial riblets almost as closely approximated as those in typical *P. (P.) erecta erecta*, but they are a little less elevated. It agrees with *P. (P.) erecta ramonensis* in having the strong interrupted spiral bands of brown. The peristome is separated from the preceding turn at the parietal wall.

The type, U.S.N.M. No. 367778, has 4.2 whorls remaining, and measures: Length, 14.0 mm.; greater diameter, 7.2 mm.; lesser diameter, 6.1 mm.

PARACHONDRIA (PARACHONDROPS) ERECTA RAMONENSIS, new subspecies

PLATE 20, FIGURE 4

This subspecies was collected by Gundlach at El Ramon, east of Santiago. It differs from the typical race in being smaller, in having the whorls a little more rounded, and in having the axial ribs more distantly spaced and more irregular in development; that is, heavy and fine riblets are present. The tufts at the summit are also heavier and are less inclined to consist of fused riblets. The interrupted spiral bands of brown are quite strong, and the peristome at the parietal wall touches the preceding turn.

The type, U.S.N.M. No. 367780, has 4.2 whorls remaining and measures: Length, 13.7 mm.; greater diameter, 7.0 mm.; lesser diameter, 6.3 mm.

PARACHONDRIA (PARACHONDROPS) ERECTA ERECTA ([Gundlach] Pfeiffer)

PLATE 20, FIGURE 2

1858. *Cyclostoma erectum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 5, p. 189.

1865. *Chondropoma erectum* PFEIFFER, Monographia pneumonopomorum viventium, vol. 3, p. 156.

1920. *Chondropoma (Chondropomorus) erectum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 61.

The typical subspecies comes from the region of Santiago. It is larger than the others and it has the spiral sculpture on the last whorl

strongly developed, the axial ribs slender and sublamellar, and the brown spiral bands merely indicated.

The specimen figured, U.S.N.M. No. 367779, which was collected by Gundlach at El Morro de Santiago, has 4.8 whorls remaining and measures: Length, 16.0 mm.; greater diameter, 8.2 mm.; lesser diameter, 7.0 mm.

PARACHONDRIA (PARACHONDROPS) ERECTA TURQUINENSIS, new subspecies

PLATE 20, FIGURE 3

This race was collected by Jeanneret on Pico Turquino. It differs from the other races in having the axial riblets much less strongly elevated and less strongly developed and much more closely approximated, with the spiral sculpture much enfeebled, almost obsolete on the last turn. The whorls are also a little more inflated and very conspicuously denticulated at the summit. The interrupted spiral color bands are moderately strong. The last whorl is slightly solute.

The type, U.S.N.M. No. 367781, has 5.1 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 7.1 mm.; lesser diameter, 6.0 mm.

PARACHONDRIA (PARACHONDROPS) LURIDA ([Gundlach] Pfeiffer)

PLATE 21, FIGURE 13

1858. *Cyclostoma lurida* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, pp. 4, 12, *nomen nudum*.

1858. *Cyclostoma luridum* [Gundlach] PFEIFFER, Malakazool. Blätter, vol. 5, pp. 45-46.

1865. *Tudora lurida* PFEIFFER, Monographia pneumonopomorum viventium, Suppl. 2, p. 137.

1920. *Parachondria* (*Parachondrops*) *lurida* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Shell elongate-conic, pale yellow, the interior pale yellow, the peristome flesh colored. Nuclear whorls decollated in all our material. Postnuclear whorls moderately well rounded, narrowly shouldered at the summit, marked by feeble, slightly retractively slanting axial riblets, which become expanded to form hollow tufts at the summit. These tufts are not all of the same size and are rather irregularly developed. In the specimen described and figured, 80 axial riblets occur upon the first of the remaining turns, 100 upon the second, 110 upon the third, and 104 upon the last. The spiral sculpture consists of slender, low, rounded threads, of which 6 occur upon the first and second turns, 8 upon the third and fourth, and 9 upon the last, between the summit and the suture. The junctions of the axial riblets and the spiral threads form slender, elongated nodules, which have their long axis parallel with the axial sculpture, while the spaces enclosed between them are more or less rectangular, shallow areas. Suture strongly

constricted. Periphery strongly rounded. Base moderately long, strongly rounded, narrowly umbilicated, marked by the continuation of the axial ribs and by 8 spiral threads of about the same strength as those on the spire, while within the umbilicus 5 additional spiral threads are present. Last whorl solute for about one-fourth of a turn, and slightly deflected. Aperture broadly oval; peristome double, the outer expanded into a conspicuous auricle at the posterior angle, narrow on the outer lip, and wider on the inner and basal lip, and again narrow on the parietal wall; the inner moderately exerted and rather broadly expanded. Operculum paucispiral with the nucleus halfway between submarginal and subcentral; the turns are marked on the outside by numerous, retractively slanting lamellae, which extend over about three-fifths of the whorls, fusing on the inner surface; the outer two-fifths of the turns are without reinforcement.

The specimen described and figured, U.S.N.M. No. 355391, comes from the type locality, Guisa, southeast of Bayamo, Oriente Province. It was part of the Redfield collection and it was probably received from Poey or Gundlach. It has a little over 4 whorls remaining and measures: Length, 15.5 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.5 mm.

PARACHONDRIA (PARACHONDROPS) ABTIANA (Pfeiffer)

PLATE 21, FIGURE 11

1862. *Tudora abtiana* PFEIFFER, Malakozool. Blätter, vol. 9, p. 4.

Shell elongate-conic, pale wax yellow with interrupted spiral bands of brown. Nuclear whorls decollated in all our specimens. Postnuclear whorls well rounded and marked by slender, slightly elevated, rather closely spaced axial riblets, which are gathered into hollow tufts at more or less regular intervals at the summit. The spiral sculpture consists of feeble threads, just strong enough to render the axial riblets wavy or articulate. Suture well constricted. Periphery somewhat inflated, well rounded. Base short, well rounded, marked by the continuation of the axial ribs and by spiral threads that are obsolete, except within the umbilicus and the anterior two-thirds of the base, where they become more intensified. The last whorl is solute for about one-fifth of a turn. Aperture oval; peristome double, the outer slightly auriculate at the posterior angle, rather heavy and expanded, very slightly wider on the columellar margin than on the inner lip; the inner slightly exerted, reflected, and appressed to the outer. Operculum paucispiral, with a heavy deposit of calcareous material, which is arranged in retractively curved folds suggesting a development midway between *Chondropoma* and *Parachondria*.

The specimen figured, U.S.N.M. No. 11055, is one of 3 collected by Wright at Saltadero, Guantánamo. It has 4.2 whorls remaining and

measures: Length, 15.4 mm.; greater diameter, 7.6 mm.; lesser diameter, 6.5 mm.

The species is easily distinguished from *P. (P.) erecta* and *P. (P.) lurida* by its much less strongly developed sculpture.

PARACHONDRIA (PARACHONDROPS) DAUDINOTI ([Gundlach] Pfeiffer)

PLATE 21, FIGURE 9

1860. *Cyclostoma daudinoti* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6, pp. 69–70.

1865. *Choanopoma daudinoti* PFEIFFER, Monographia pneumonopomorum viventium, Suppl. 2, p. 105.

Shell small, elongate-conic, dark horn colored. Nuclear whorls decollated in all our specimens. Postnuclear whorls somewhat inflated, well rounded, marked by narrow, sublamellar axial ribs, of which some are stronger than others, with 2 or even more finer riblets between the strong ones. Some of these riblets become expanded at the summit to form denticles, a few of which are rather heavy and hollow. The spiral sculpture consists of mere indications of threads, which, however, render the ribs of the early whorls slightly scalloped and sinuous, that is, articulate. On the last whorl the spiral sculpture is obsolete. Periphery of the last whorl strongly rounded. Here, too, the axial riblets are a little more closely approximated than on the early whorls. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, well rounded, moderately broadly, openly umbilicated, marked by the continuations of the axial riblets and by 2 faint spiral threads outside of the umbilical margin and by 3 strong spiral threads within the umbilicus, which here render the axial riblets scalloped. Last whorl solute for about one-fifth of a turn. Aperture very broadly oval, almost subcircular; peristome double, the outer flaringly expanded all around except on the parietal wall, where it is quite narrow, marked by a series of concentric lamellae; the inner slightly exserted and slightly expanded. Operculum typically parachondroid, i. e. upon the chondroid base there is a strong development of retractively curved axial riblets, which are fused on the inside, and which become diminished as they approach the periphery, vanishing before reaching the outer extremity. This is the only Cuban species we know in which the operculum agrees with the Jamaican species in the strong development of the opercular characters.

The specimen figured, U.S.N.M. No. 355387, comes from Monte Toro, Guantánamo. It has 5.1 whorls remaining and measures: Length, 8.9 mm.; greater diameter, 4.3 mm.; lesser diameter, 3.4 mm.

Gundlach says of the animal: "On rocks. Animal whitish, neck a little brownish, white about the eyes. Blackish dots on the head form a longitudinal line on each side which passes through the base of

its antennae. Tentacles brownish at the apex. A dark longitudinal streak is present between the neck and foot. Some individuals are a little more rusty in color."

PARACHONDRIA (PARACHONDROPS) CHORDATA ([Gundlach] Pfeiffer)

Shell elongate-conic, pale brown, marked by interrupted spiral bands of brown. Aperture flesh colored within, showing the spiral bands inside. The nuclear whorls are strongly rounded; the beginning of the nuclear turns are smooth; the rest of the first turn is marked by wavy, raised spiral cords, while the last turn is marked by distantly spaced, scalariform axial riblets. Postnuclear whorls strongly rounded, marked by closely spaced, sublamellar axial riblets, which become expanded at the summit, or several of them fuse to form toothlike elements. The spiral sculpture consists of about 5 low, rounded, broad cords which render the axial riblets scalloped. Suture strongly constricted. Base moderately long, well rounded, narrowly umbilicated, marked by 4 spiral cords. Another one is apparent within the umbilicus. Aperture broadly oval; peristome double, the outer broadly expanded, appressed to the preceding turn with the parietal portion; the inner peristome slightly projecting, moderately expanded, and reflected. Operculum thin, corneous, paucispiral, with the nucleus halfway between subcentral and marginal; the outside covered with a rather thick calcareous deposit, which bears the usual retractively curved parachondroid ridges, which are not strongly developed at this point.

This species ranges through a large part of Oriente Province and breaks up into a number of subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF PARACHONDRIA (PARACHONDROPS) CHORDATA

Both peristomes broadly, flaringly expanded.

Shell large, more than 10 mm. long..... **tanamensis**

Shell small, less than 8 mm. long..... **baracoensis**

Both peristomes not broadly, flaringly expanded.

Sculpture strong.

Axial riblets very closely spaced..... **mayariensis**

Axial riblets less closely spaced.

Spiral cords of base very strong..... **songoensis**

Spiral cords of base not very strong..... **guantanamensis**

Sculpture feeble..... **chordata**

PARACHONDRIA (PARACHONDROPS) CHORDATA TANAMENSIS, new subspecies

PLATE 21, FIGURE 3

In this race, which comes from El Coco, south of Sagua de Tánamo, Oriente, both peristomes are broadly expanded. In this character it

resembles *P. (P.) chordata baracoensis*, from which it is easily distinguished by its much larger size.

The type, U.S.N.M. No. 367788, was collected by Arango. It has 4.2 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 5.9 mm.; lesser diameter, 5.2 mm.

PARACHONDRIA (PARACHONDROPS) CHORDATA BARACOENSIS, new subspecies

PLATE 21, FIGURE 10

In this race, which comes from Silla de Baez, west of Baracoa, both peristomes are flaringly expanded, as in *P. (P.) chordata tanamensis*, but the shell of *baracoensis* is smaller.

The type, U.S.N.M. No. 535334, has 4.5 whorls remaining and measures: Length, 7.8 mm.; greater diameter, 4.2 mm.; lesser diameter, 3.3 mm.

PARACHONDRIA (PARACHONDROPS) CHORDATA MAYARIENSIS, new subspecies

PLATE 21, FIGURE 8

This race was collected by Jeanneret at Picote, and by John B. Henderson at Piedra Gorda, Mayari, Oriente Province. It belongs to the group which has the inner peristome narrowly expanded, with strong axial and spiral sculpture, and with the axial riblets very closely spaced, in which character it differs from *P. (P.) chordata songoensis* and *P. (P.) chordata quantanamensis*.

The type, U.S.N.M. No. 367789, has 4.3 whorls remaining and measures: Length, 9.0 mm.; greater diameter, 4.8 mm.; lesser diameter, 3.8 mm.

PARACHONDRIA (PARACHONDROPS) CHORDATA SONGOENSIS, new subspecies

PLATE 21, FIGURE 2

This race was collected by Dr. Ramsden at Reuter, Alto Songo, Oriente. It, also, belongs to the group in which the inner peristome is only slightly expanded. It is most nearly related to *P. (P.) chordata quantanamensis*; both of these subspecies have the axial riblets distantly spaced, but in *songoensis* the spiral cords of the base are very strong, which character differentiates it from *quantanamensis*.

The type, U.S.N.M. No. 367767, has 4.8 whorls remaining and measures: Length, 9.6 mm.; greater diameter, 6.0 mm.; lesser diameter, 3.7 mm.

PARACHONDRIA (PARACHONDROPS) CHORDATA GUANTANAMENSIS, new subspecies

PLATE 21, FIGURE 12

This race comes from the Yateras region, Guantánamo. It belongs to the group that does not have both peristomes flaringly expanded,

the inner being only slightly expanded. It is most nearly related to *P. (P.) chordata songoensis*, with which it shares the rather distant spacing of the axial riblets, but from which it is differentiated by its much weaker basal spiral cords

The type, U.S.N.M. No. 493357, a complete specimen, has 7.5 whorls and measures: Length, 12.6 mm.; greater diameter, 5.4 mm.; lesser diameter, 4.8 mm.

PARACHONDRIA (PARACHONDROPS) CHORDATA CHORDATA ([Gundlach] Pfeiffer)

PLATE 21, FIGURE 1

1858. *Cyclostoma chordatum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 5, p. 189.

1861. *Adamsiella chordatum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 353 (27).

1920. *Chondropoma (Chondropomorus) chordatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 61.

The typical race comes from Enramadas, in the region of Santiago, Oriente. It also belongs to the group that has the inner peristome only slightly expanded and reflected. It differs from all the other members of that group in having both the axial and spiral sculpture quite feebly expressed.

The specimen figured, U.S.N.M. No. 493354, a cotype received from Gundlach, has 4.5 whorls remaining, and measures: Length, 10.1 mm.; greater diameter, 5.4 mm.; lesser diameter, 4.3 mm.

PARACHONDRIA (PARACHONDROPS) NIGRICULA (Gundlach)

PLATE 21, FIGURE 7

1860. *Cyclostoma nigriculum (Ctenopoma)* GUNDLACH, Malakozool. Blätter, vol. 7, p. 28.

1861. *Ctenopoma nigriculum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1920. *Parachondria (Parachondrops) nigricula* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Shell elongate-conic, pale yellow, with the inner peristome white. Nuclear whorls decollated in all our specimens. Postnuclear whorls slightly inflated, well rounded, marked with retractively slanting, slender axial ribs, of which 40 occur upon the first of the remaining turns, 72 upon the second, 90 upon the third, 126 upon the fourth, and 144 upon the last. These ribs are not all of the same strength, but a series of taller ones alternate with more slender elements, the taller ones forming expanded tubercles at the summit, which here give to these groups a somewhat tufted appearance. The spiral sculpture consists of obsolete cords, which render the riblets slightly wavy. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, narrowly, openly umbilicated, marked by the continuation of the axial ribs and by a strong spiral

cord marking the termination of the umbilicus. Aperture subcircular; peristome double, the outer expanded a little less on the parietal wall than on the rest, marked by a series of concentric lamellae; the inner slightly exserted and reflected. Operculum paucispiral, with the nucleus halfway between subcentral and submarginal; the whorls are marked by feeble, retractively curved, slender lamellae, which do not quite extend to the outer edge of the chondroid plate.

The specimen described and figured, U.S.N.M. No. 57136, is one of 5 collected by Arango on El Yunque. It has a little over 5 whorls and measures: Length, 9.8 mm.; greater diameter, 4.9 mm.; lesser diameter, 3.8 mm.

Additional series of specimens before us come from Baracoa, El Yunque, and Mata east of Baracoa.

In this species the males are much smaller than the females. Gundlach says of this species: "On stones and trees at Baracoa, Yunque and Mata. Animal brownish with dark dots which become confluent into spots on the snout, the head and part of the neck. Eye ring rose red-white. Tentacles bright coral red with gray apex. The space between neck and foot is dark gray."

Subfamily ADAMSIELLINAE Henderson and Bartsch

1920. Adamsiellinae HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 70.

Shell ranging in form from ovate-conic to elongate-conic, marked by axial and spiral sculpture of equal strength, this sculpture giving the surface a granulose appearance, or marked by axial ribs which are stronger than the spiral threads, the latter giving the ribs an articulate appearance. In two groups the ribs are gathered into tufts at the summit. No special breathing device has been observed in any of the species. The operculum consists of a chondroid basal plate composed of several whorls, in which the upturned outer edge of the preceding whorl is strengthened and built into a strongly elevated lamella by the inner edge of the succeeding turn. There is no ribbing or buttressing to this lamella.

Type genus.—*Adamsiella* Pfeiffer.

Genus ADAMSIELLA Pfeiffer

1851. *Adamsiella* PFEIFFER, Zeitschr. Malac., vol. 8, p. 155.

CUBADAMSIELLA, new subgenus

Shell ranging in shape from ovate to elongate-conic. Nuclear whorls smooth, except for microscopic granulations; the last portion of the last whorl usually showing the feeble beginning of the post-nuclear axial ribs. The postnuclear axial sculpture consists of slender sublamellar axial riblets. The spiral sculpture varies from obsolete threads to nothing; when present it renders the axial ribs articulate.

The last whorl is usually solute. The peristome is double, the outer expanded but not thickened. Operculum typically adamsiellid with fine hairlike extensions on the outside of the chondroid basal plate radiating from the raised lamella anteriorly.

Type: *Adamsiella* (*Cubadamsiella*) *gratiosa*, new species.

The sublamellar axial ribs and thin outer peristome readily distinguish this subgenus from the Jamaican *Adamsiellops*.

Typical *Adamsiella* is not found in Cuba. So far we have found only the present subgenus in the island.

KEY TO THE SPECIES OF THE SUBGENUS CUBADAMSIELLA

Shell elongate-ovate.....	gratiosa
Shell elongate-conic.....	
Axial ribs scalloped.....	leoni
Axial ribs not scalloped.....	procax

ADAMSIELLA (CUBADAMSIELLA) GRATIOSA, new species

PLATE 21, FIGURE 4

Shell elongate-ovate, varying in color from wax yellow to pale orange. Nuclear whorls a little more than 1.5, well rounded, and marked by microscopic granules. Postnuclear whorls inflated, strongly rounded, marked by very slender, rather distantly spaced, sublamellar axial riblets. The broad intercostal spaces and the sides of the ribs are marked in addition by exceedingly fine, microscopic, wavy incremental lines. There are about 40 of these riblets on the first whorl and about 55 on the last. The spiral sculpture is absent on the spire. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, openly umbilicated, and marked at the umbilical edge by a feebly developed spiral thread. There are also some faint indications of another thread a little farther within. The last whorl may be solute or adnate to the preceding turn. The outside of the parietal wall is marked with the continuation of the axial ribs. Aperture very broadly oval, almost circular; peristome double, the outer thin, expanded, a little narrower on the parietal wall, slightly auriculate at the posterior angle; the inner slightly exerted and slightly reflected. Operculum with an almost central nucleus and a strongly elevated lamella rising from the inner edge of the turns, which is slightly outcurved at the free edge. The spaces between the lamellae are marked by fine granules. In some of these specimens there is a slight indication of distantly spaced, slender, recurved threads between the lamellae.

The type, U.S.N.M. No. 535339, was collected by Bartsch at Guajabana, Santa Clara Province, on the western end of the hill north of the railroad track. It has 6.4 whorls and measures: Length. 7.0 mm.; greater diameter, 3.9 mm.; lesser diameter, 3.4 mm.

We found this species rather widely distributed in Santa Clara Province. We have seen specimens from the northeast slope of La Puntilla; from the lomas de Ramón Martínez, between Remedios and Zulueta; from Charco Majá, north slope of Loma Platero a little east of Yagüey; Vereda del Resbalillo Cambao, near Remedios; and Guajabos.

ADAMSIELLA (CUBADAMSIELLA) LEONI, new species

PLATE 21, FIGURE 5

Shell small, thin, elongate-conic, of wax yellow ground color with interrupted spiral bands of brown, which are arranged in both axial and spiral series. These color bands are shown within the aperture. Nuclear whorls 2, forming a rather large, somewhat mammillated blunt apex, with the whorls inflated, strongly rounded, and microscopically granulose. Postnuclear whorls slightly shouldered, strongly rounded, and marked by strong, distantly spaced, lamellar axial ribs, which are separated by finer axial threads. These vary in number from 3 to 6. The heavy axial ribs extend prominently to the summit and here develop into toothlike elements. The spiral sculpture consists of ill-defined threads, which render the axial ribs vertebrated and the larger of the axial ribs scalloped at their free margin. Suture strongly constricted. Periphery strongly rounded. Base short, strongly rounded, very openly umbilicated, and marked by the continuation of the axial ribs and by feeble spiral threads. The last whorl is solute for about one-half of a turn, with the outside of the parietal wall marked by the continuations of the axial ribs, but with no indication of spiral sculpture. Aperture circular; peristome double, the outer thin, narrowly expanded and a little narrower on the parietal wall than on the rest. The inner decidedly exserted and slightly reflected at its free edge. Operculum thin, corneous, with almost central nucleus. The whorls are provided with a strong, decidedly elevated lamella at their inner edge, which is bent slightly outward at the free margin. There are fine calcareous granules in the spaces between the lamellae.

The type, U.S.N.M. No. 535337, which was collected by Hermano Leon at Cabezadas del Caracusey, Sierra de Gavilanes, Santa Clara Province, has 5.2 whorls remaining and measures: Length, 7.1 mm.; greater diameter, 4.0 mm.; lesser diameter, 3.3 mm.

A larger specimen has 5.3 whorls remaining and measures: Length, 9.0 mm.; greater diameter, 4.5 mm.; lesser diameter, 3.5 mm. This specimen, and the one from which the nucleus and operculum were described, are listed as U.S.N.M. No. 535338.

ADAMSIELLA (CUBADAMSIELLA) PROCAX (Poey)

PLATE 21, FIGURE 6

1851. *Cyclostoma procax* POEY, *Memorias sobre la historia natural de la isla de Cuba*, vol. 1, pp. 104, 106, pl. 7, figs. 12-14.

1854. *Cistula? procax* PFEIFFER, *Malakozool. Blätter*, vol. 1, p. 95.

Shell small, elongate-conic, of wax yellow ground color with interrupted spiral bands of brown, which are arranged in both axial and spiral series. Nuclear whorls almost 2, forming a somewhat mammillated blunt apex, with the whorls inflated, strongly rounded, and microscopically granulose. Postnuclear whorls very inflated and strongly rounded, the first one marked by about 60 threadlike, retractively curved axial riblets. These riblets become decidedly diminished on the next whorl, which has only about 40. From this point they increase in number on each turn to the last whorl, which shows more than 60. Beginning with the second whorl and continuing through the last turn, the riblets become sublamellar, and are rendered sinuous and slightly vertebrated by the poorly developed spiral threads, which are almost obsolete. These riblets extend prominently to the summit, but they scarcely show indications of becoming enlarged at the summit. Suture very strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, very openly umbilicated, marked by the continuations of the axial riblets and by a faint suggestion of spiral threads. The axial riblets extend into the open umbilicus, but here there is no indication of spiral sculpture. The last whorl is solute for about one-fourth of a turn. Aperture very broadly oval, almost circular, not evenly curved, the outer lip being much more strongly arched than the inner; peristome double, the outer thin, narrow, flaringly expanded and slightly auriculate at the posterior angle, a little wider on the outer lip than on the parietal wall; the inner peristome is slightly exserted and reflected, very distinct from the outer, the inner peristome showing the external color bands. Operculum thin, corneous, with subcentral nucleus and with a thin lamella rising on the inner edge of the turns, which is slightly outward bent. The rest of the operculum is covered by fine granules.

The specimen figured, one of nine, U.S.N.M. No. 535336, has 9.2 whorls and measures: Length, 9.8 mm.; greater diameter, 4.3 mm.; lesser diameter, 3.2 mm.

This species, for which Poey did not cite a locality, was lost for some time. It has recently been rediscovered by Hermano León at Lomas de Buenos Aires, between Cienfuegos and Trinidad.

Subfamily ANNULARIINAE Henderson and Bartsch

1920. *Annularinae* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 71.

Shell ranging in form from depressed-helicoid to elongate-conic. The axial sculpture may be almost obsolete or it may consist of strong ribs or many slender lamellae, which may or may not be gathered into tufts at the summit. The spiral sculpture may be absent, confined to the umbilicus, or cover spire and base. In strength the spiral sculpture varies from fine threads to strong cords. Breathing devices are present in some groups and absent in others. They range from a mere notch or slit puncture to a pore with external siphon. The operculum may be flat or convex on the outside, provided with a calcified lamella, which rises from the inner edge of the whorls. This lamella may be vertically placed upon the basal plate or it may be obliquely situated or reflected to parallel the basal plate. It may be almost smooth or ribbed.

Type genus.—*Annularia* Schumacher.

KEY TO THE GENERA OF THE SUBFAMILY ANNULARIINAE

Outer edge of the opercular lamella touching that of the succeeding whorl, thus forming a continuous surface.

Nuclear whorls thimble-pitted.

Nuclear whorls with axial ribs and spiral threads..... **Limadorex**

Nuclear whorls without axial ribs or spiral threads..... **Limadora**

Nuclear whorls not thimble-pitted.

Nuclear whorls microscopically granulose..... **Tudora**

Outer edge of the opercular lamella not touching that of the succeeding whorl, thus not forming a continuous surface.....

Annularia

LIMADOREX, new genus

Small tudorids having the nuclear whorls thimble-pitted and in addition provided with axial riblets and spiral threads, which characters at once distinguish it from *Limadora*. The postnuclear whorls are marked by sublamellar, wavy axial ribs. Peristome double. Breathing puncture present.

Type: *Limadorex limonensis*, new species.

LIMADOREX LIMONENSIS, new species

PLATE 22, FIGURES 6, 7

Shell rather large, elongate-conic, pale yellow. Nuclear whorls 2, strongly rounded, with the first whorl showing indications of retractorily slanting axial ribs and with the entire surface thimble-pitted. Postnuclear whorls inflated, strongly rounded, marked by slightly retractorily slanting axial riblets, of which 102 occur on the first of the remaining turns, 138 on the second, and 158 on the last. These riblets are not quite so wide as the spaces that separate them, and they are expanded at the summit and at the periphery into more or less auricular elements, which are usually fused. The spiral sculpture con-

sists of feeble indications of threads, which render the axial riblets wavy. Of these, 7 appear to be present on all the whorls. Suture strongly constricted. Periphery strongly rounded. Base marked by the continuation of the axial ribs and by 7 spiral threads, which render the riblets slightly scalloped. Aperture almost circular; peristome double, the outer broadly expanded, deeply notched on the middle of the inner lip and reflected posterior to this, and appressed to the base, completely covering the umbilicated area; the outer peristome is marked by slender concentric lamellae; inner peristome slightly exserted. Operculum typically tudorid.

The type, U.S.N.M. No. 356392, was collected on El Toro, Sierra de Limones, Pinar del Rio, by Henderson and Bartsch in 1916. It has almost 4 whorls and measures: Length, 7.6 mm.; greater diameter, 4.5 mm; lesser diameter, 3.5 mm.

The peculiar thimble-pitting of the nuclear whorls will distinguish this species from all the other western Cuban annularids. It is distinguished from *Limadora* proper by the possession of a breathing pore and a double peristome.

LIMADORA, new genus

Annularids in which the nuclear whorls are pitted and rough like a rasp, characters which distinguish this group from all the other members of the family, for in the rest the nuclear whorls are either smooth or only microscopically granulose. The operculum is typically tudorid, i. e., the whorls are provided with a lamella which rises from the inner edge of the turns, and which is reflected outward to parallel the basal chondroid plate, and which extends to the outer edge of the whorls, thus forming a continuous surface without a channel between the turns, in which the chondroid basal plate is visible. The lamella is marked by retractively curved threads. Peristome simple. Breathing pore absent.

Type: *Limadora tollini* (Ramsden).

KEY TO THE SPECIES OF LIMADORA

Shell of trochid outline.....	tollini
Shell not of trochid outline.	
Shell elongate-ovate or elongate-conic.	
Umbilicus narrowly perforate.....	garciana
Umbilicus imperforate.....	scabrata

LIMADORA TOLLINI (Ramsden)

PLATE 22, FIGURES 1, 4

1915. *Rhytidopoma tollini* RAMSDEN, Nautilus, vol. 28, pp. 135-136, pl. 6, fig. 5.

1920. *Ramsdenia tolleni* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

Shell of trochid outline, flesh colored with a yellowish tinge. Nuclear whorls almost 2, strongly rounded, rough like a coarse rasp.

Postnuclear whorls very strongly inflated and strongly rounded, the first marked by fairly regularly distantly spaced axial riblets, which are slightly wavy, the rest by lamellose axial riblets, which are rendered scalloped at regular intervals. Of these scallops, 4 occur between the summit and the periphery of the whorls. Suture very strongly constricted. Periphery inflated, strongly rounded. Base very broadly, openly umbilicated, marked by the continuation of the axial ribs and three series of scallops. The outer edge of the umbilicus is limited by a strong spiral cord, and the umbilical wall has 8 low spiral threads, which also render the axial ribs slightly scalloped. The last whorl is solute for about one-fifth of a turn. Aperture subcircular; peristome simple. Operculum tudorid.

The specimen described and figured, U.S.N.M. No. 493473, a topotype, was collected by Oscar Tollin 15 miles south of Media Luna, on the road to Pilón, Oriente Province. It has 5.1 whorls and measures: Length, 7.0 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.3 mm.

LIMADORA GARCIANA (Aguayo)

Shell varying from elongate-conic to elongate-ovate, flesh colored, with a yellowish tinge. Nuclear whorls 2, well rounded, rough, with a surface resembling that of a coarse rasp. Postnuclear whorls somewhat inflated, well rounded, marked by rather strong, hollow, retractively slanting, sublamellose axial riblets, which project at the summit as slender auricles. The spiral sculpture consists of obsolete threads, which render the axial riblets scalloped. Suture strongly constricted. Periphery well rounded. Base well rounded, very narrowly, openly umbilicated, marked by the continuation of the axial riblets and by spiral cords, the latter a little stronger than those on the spire; the junction of the spiral cords with the axial ribs render the latter strongly scalloped. Last whorl solute for almost half a turn, which gives a free view of the umbilical wall, which is marked by the continuation of the axial riblets and by spiral threads, the latter forming narrow scallops at their junction with the axial riblets. Aperture very broadly oval; peristome double, the inner projecting scarcely above the outer; the outer only slightly expanded. Operculum typically tudorid.

This species is found in the region of Santa Lucia, Oriente Province. We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF LIMADORA GARCIANA

Spiral cords on spire 4.....	sillaensis
Spiral cords on spire 5.....	garciana

LIMADORA GARCIANA SILLAENSIS, new subspecies**PLATE 22, FIGURE 2**

The type of this subspecies was collected by Mr. Henderson at La Silla, Santa Lucia, Oriente Province. It is distinguished from *L. garciana garciana* in having the whorls higher, in being much more elongate, in having the last whorl more solute, and in having one spiral cord less on the whorls than in the typical race.

The type, U.S.N.M. No. 356385, has 4.4 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 5.6 mm.; lesser diameter, 5.2 mm.

LIMADORA GARCIANA GARCIANA (Aguayo)**PLATE 22, FIGURE 5**

1932. *Ramsdenia garciana* AGUAYO, Occ. Pap. Boston Soc. Nat. Hist., vol. 8, p. 32, pl. 3, fig. C.

This subspecies comes from Sao Arriba, some 4 miles northeast of Holguín, Oriente Province. It differs from *L. garciana sillaensis* in having the whorls less high. *L. garciana garciana* therefore has a chubbier general appearance than *sillaensis*, and it has one more spiral thread on the turns.

The specimen described and figured, U.S.N.M. No. 493513, is a topotype having 3.6 whorls remaining and measures: Length, 9.7 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.4 mm.

LIMADORA SCABRATA, new species**PLATE 22, FIGURE 3**

Shell elongate-conic, flesh colored, with a yellowish tinge, and marked by two interrupted spiral bands of brown; the spots composing these are rather broad and large. There is an additional spiral band of the same color and practically the same size on the base. Nuclear whorls almost 2, well rounded, roughened like a file. Postnuclear whorls marked by retractively curved, sublamellar axial riblets, which are hollow near the summit, where they become expanded into cusps. There is also a tendency toward hollowness in three additional scallops on the whorls between the summit and the suture. The spaces separating the axial riblets are about twice as wide as the riblets. Suture very strongly constricted. Periphery well rounded, marked by a scallop on the ribs. Base rather short, well rounded, and marked by the continuation of the axial ribs, which bear two additional scallops; these scallops are stronger than those on the spire. The base is very narrowly umbilicated, but the umbilicus is not perforated. On the parietal wall, inconspicuous spiral threads are indicated. The last whorl is solute for about one-tenth of a turn. Aperture broadly oval; peristome simple. Operculum typically tudorid. In imma-

ture specimens the umbilicus is broadly open and the umbilical wall is marked by 4 spiral cords, which are strongly scalloped at their junction with the axial ribs.

The type, U.S.N.M. No. 493416, was collected by Dr. Victor Rodriguez at Finca Santa Maria (de Riveron), Martí, Loma de Sibanicú, Camagüey Province. It has 4.2 whorls remaining and measures: Length, 10.5 mm.; greater diameter, 5.7 mm.; lesser diameter, 4.8 mm.

Genus TUDORA Gray

1850. *Tudora* GRAY, Nomenclature of molluscos animals and shells in the collection of the British Museum, pt. 1, Cyclophoridae, p.48.

Shell ranging from helicoid to elongate-conic in form, marked by axial ribs only, or with axial ribs and spiral sculpture. The latter may be confined to the umbilicus or it may be present on spire and base. The axial sculpture varies from strong to almost obsolete, or it may consist of slender, sublamellar riblets. The spiral sculpture is equally variable as to strength in the different species. Breathing devices may be present or absent in this genus. The operculum has a basal chondroid plate composed of a number of whorls, the inner edge of which develops a strong calcified lamella, which is reflected outward until it parallels the basal chondroid plate, to which it is connected by calcareous bars. The lamella extends to the outer edge of the whorls of the operculum and thus forms a continuous surface on the outside. The lamella is usually marked by fine, retractively slanting striations or riblets.

Type: *Cyclostoma megacheilos* Potiez and Michaud.

KEY TO THE CUBAN SUBGENERA OF THE GENUS TUDORA

Breathing device present.

Shell with breathing siphon..... **Eutudorops**

Shell with breathing puncture..... **Eutudorex**

Breathing device absent.

Early postnuclear whorls solute..... **Ramsdenia**

Early postnuclear whorls not solute.

Shell of helicoid shape..... **Gundlachtudora**

Shell not of helicoid shape.

Peristome simple..... **Wrightudora**

Peristome double.

Axial ribs vertebrated..... **Aguayotudora**

Axial ribs not vertebrated..... **Tudorina**

Subgenus EUTUDOROPS Henderson and Bartsch

1920. *Eutudorops* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 78-79.

The first half nuclear whorl is microscopically granulose; the rest of the nuclear turns are marked by distantly spaced axial ribs. Shell ranging from ovate-conic to elongate-conic, the axial sculpture of the

postnuclear whorls consisting of slender, sublamellar riblets, which are rendered wavy by the low rounded spiral cords. There is a breathing pore, which is provided with a siphon externally on the parietal wall near the posterior angle of the aperture a little within the edge of the peristome. Operculum typically tudorid.

Type: *Tudora (Eutudorops) torquata* ([Gutierrez] Poey).

TUDORA (EUTUDOROPS) TORQUATA ([Gutierrez] Poey)

PLATE 22, FIGURES 8, 9

1858. *Cyclostoma torquata* [Gutierrez] POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, p. 34, pl. 4, fig. 2.
1858. *Ctenopoma torquata* PFEIFFER, Monographia pneumonopomorum viventium, Suppl. 1, p. 105.
1920. *Eutudora (Eutudorops) torquata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

Shell moderately large, elongate-conic, flesh colored or pale yellow. Nuclear whorls 2, the first smooth, the second showing the ingression of the axial ribs, which here become quite strongly developed. Post-nuclear whorls inflated, strongly rounded, marked by retractively slanting axial riblets, which vary much in strength in different individuals, and which usually develop into rather conspicuous auricles at the summit and into strong scallops at the periphery; where these two elements meet the ribs frequently become fused. The spiral sculpture also varies much in strength, ranging from obsolete to strong, rounded cords. The number of spiral threads between summit and suture may vary from 4 to 8; these spiral threads render the riblets wavy or faintly scalloped. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, marked by the continuation of the axial riblets and by spiral threads, which also vary in number and strength. The reflected outer peristome of the inner lip usually completely covers the narrow umbilicus, or there may be a narrow chink left uncovered. Aperture subcircular; peristome double, the inner slightly exerted; the outer narrowly expanded on the outer and basal lip and broadly expanded on the inner lip and parietal wall, to cover the umbilicus. There is a breathing pore at the posterior angle, which continues on the outside as a heavily wrinkled, curved siphon. Operculum typical of *Tudora*.

The specimen figured, U.S.N.M. No. 493418, a cotype, was received by Dr. de la Torre from Gutierrez, who received it from El Lechuzo, which is now called Rodas. This is about 10 miles north of the Bay of Cienfuegos. It has 3.5 whorls remaining and measures: Length, 10.7 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.5 mm.

We have also figured a specimen, U.S.N.M. No. 493419, from San Isidro north of Cienfuegos, in order to show the tremendous variation in size and sculpture through which the species ranges.

This species is known only from Santa Clara Province. It is tremendously variable throughout its range as far as size and sculpture are concerned. There appears to be no constancy in the variation that would show a relationship to the zoogeographic areas occupied. We are therefore refraining from attempting to split it up into subspecies. While the extreme variations in a single locality are much greater than are frequently represented in zoogeographic races of a species, here fixation apparently has failed to become effective.

Forty lots before us range from the type locality south to Soledad to Guayos eastward to San Isidro and Loma El Capiro, and Loma de Bonachea to Loma de Santa Fe. On the north coast, following the range of mountains from the west eastward we have seen it from Corralillo, Santa Teodosia, Pilar, Ramona, Lutgardita, Zambumbia, Flor de Cuba, Finca Delicia, Capitolio, Jumaguas, Arboleda, Loma de la Viruela, Finca el Miradero, Finca Oriente, Finca Santa Clara, El Purio, Mogote de la Sierra, El Guajén, El Rincón, Loma Sola, El Hacha, Loma Murciélagos, El Palenque, La Puntilla, Charco Maja, Mogote de Ramon Martinez, Central San Agustín, Mogote Buena Vista, Cayo Conuco, Cerro de Guajabana, Sierra de Meneses opposite Juncalito, east of Yaguaajay, and Sierra de Jatibonica at Los Broqueles.

Bartsch collected living specimens of this species at Central San Agustín on Mogote de Ramon Martinez, August 6, 1928. He described it as flesh colored with a slight grayish area between the tentacles, showing a pinkish tinge. The upper portion of the side of the body ashy, the tentacles varying from flesh colored to pale yellow. Sole of the foot medially cleft, flesh colored. The animal suspends itself by a mucous thread when it is at rest.

EUTUDOREX, new subgenus

Small tudorids of ovate or elongate-ovate outline, with lamellar or sublamellar, wavy axial ribs. The spiral sculpture on the spire may be obsolete or consist of strong cords. The umbilicus may be open or closed. Aperture almost circular; peristome double. The outer peristome may be notched on the inner lip or it may be entire. Operculum typically tudorid. A breathing pore is present on the parietal wall near the posterior angle, a little within the edge of the peristome.

The members of the subgenus are confined to Pinar del Rio Province.

Type: *Tudora* (*Eutudorex*) *rotundata* (Poey).

KEY TO THE SPECIES OF THE SUBGENUS EUTUDOREX

Outer peristome of inner lip notched and reflected over the umbilicus.

Spiral cords of spire very strong, broad, and closely spaced..... **welchi**

Spiral cords of spire not very strong, or broad, or closely spaced.

Spiral cords of spire weak or obsolete.

Axial ribs uniform..... **rotundata**

Axial ribs not uniform.

Axial ribs consisting of alternating strong and lesser series.....

undosa

Spiral cords of spire not weak or obsolete.

Spiral cords absent.....

pulverulenta

Outer peristome of inner lip not notched or reflected over the umbilicus.

Outer peristome decidedly expanded.....

rocal

Outer peristome moderately expanded.

Axial ribs uniform.....

complanata

Axial ribs not uniform.

Axial ribs consisting of alternating series of strong and

lesser series.....

troscheli

TUDORA (EUTUDOREX) WELCHI, new species

PLATE 23, FIGURE 6

Shell rather large, elongate-conic, flesh colored with a brownish flush. Nuclear whorls decollated in all our specimens. Postnuclear whorls well rounded, slightly shouldered at the summit, marked by closely crowded, vertebrated axial ribs, of which 221 are present on the last turn. The axial ribs are separated by mere lines; at intervals, however, there is a little wider space, which evidently marks a resting period. The spiral sculpture consists of low, broad, rounded cords separated by narrow, impressed lines, which render the axial riblets slightly nodulose. Of these cords, 7 are present between the summit and the periphery. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs and by 5 spiral cords, which are a little stronger than those on the spire and render the axial riblets nodulose. This type of sculpture extends into the umbilicus, which, however, is covered by the reflected outer peristome of the inner lip. Aperture broadly oval; peristome double, the inner slightly exerted; the outer narrowly expanded on the outer and basal lip, broadly expanded on the inner lip, on the middle of which it is notched, the portion posterior to the notch being reflected to cover the umbilicus. On the parietal wall the outer peristome is broadly expanded and adnate to the preceding turn, forming a slight hood at the posterior angle. Operculum typically tudorid.

The type, U.S.N.M. No. 493420, was collected by Dr. d'Alté A. Welch at Sierra de Paso Real de Guane. It has 3.6 whorls and measures: Length, 11.4 mm.; greater diameter, 5.9 mm.; lesser diameter, 5.0 mm.

TUDORA (EUTUDOREX) ROTUNDATA (Poey)

PLATE 23, FIGURE 2

1851. *Cyclostoma rotundatum* POEY, *Memorias sobre la historia natural de la isla de Cuba*, vol. 1, pp. 419-420, in part, pl. 34, figs. 19-21.

1856. *Ctenopoma rotundatum* PFEIFFER, *Malakozool. Blätter*, vol. 3, pp. 60, 126.

1920. *Tudora (Tudorops) rotundata* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 77.

Shell small, yellow. Nuclear whorls decollated in all our specimens. Postnuclear whorls decidedly inflated, strongly rounded, marked by almost vertical axial riblets, of which 68 occur on the first, 108 on the second, and 150 on the last; these riblets are expanded into strong auricles at the summit; they are likewise expanded at the periphery, where these two elements meet and usually fuse. The spiral sculpture consists of feeble indications of threads, of which 5 are present on the first turn, 6 on the second, and 7 on the last between summit and suture. These spiral threads render the axial riblets somewhat wavy and slightly scalloped. Suture strongly constricted. Periphery inflated, well rounded. Base rather long, well rounded, marked by the continuation of the axial riblets and by 7 spiral threads, which grow progressively stronger from the periphery toward the umbilicus, the last two about the umbilicus forming strong scallops at their junction with the axial ribs. Aperture circular; peristome double, the outer very broadly expanded, deeply notched on the middle of the inner lip, posterior to which it is reflected over the preceding turn, completely covering the umbilicus; the outer peristome is marked by slender, concentric lamellae; the inner peristome is slightly exserted. Operculum typically tudorid.

Gundlach states of this species (*Malakozool. Blätter*, vol. 3, p. 126, 1856): "It was gathered at the entrance of Santa Cruz de los Pinos under stones and decaying leaves. The animal is pale straw yellow with the tip of the feelers somewhat thickened and brownish. The upper part of the neck with an ochraceous suffusion, the sides darker."

The specimen described and figured, U.S.N.M. No. 11042, is one of 7 collected by C. Wright at Loma de Rangel, Pinar del Rio. It has 3.2 whorls and measures: Length, 6.3 mm.; greater diameter, 4.5 mm.; lesser diameter, 3.4 mm.

TUDORA (EUTUDOREX) UNDOSA ([Gundlach] Pfeiffer)

Shell small, varying in shape from elongate-ovate to elongate-conic, flesh colored with a yellowish tinge. Nuclear whorls about 2, strongly rounded, microscopically granulose, forming a slender apex. Postnuclear whorls decidedly inflated, strongly rounded, and marked by slightly retractively slanting axial ribs, which are not all of the same strength, larger sublamellar elements being separated by a number of less strongly developed and less elevated ribs. At the

summit these ribs form slight auricles which touch the preceding whorl where occasionally several of them become fused. They also become expanded near the bottom on the early turns and thus form a more or less interlocking element at the suture. The spiral sculpture consists of feeble threads, which render the axial riblets wavy or vertebrated. Suture very strongly constricted. Periphery well rounded. Base marked like the spire, but with the spiral cords more pronounced. Aperture broadly ovate; peristome double, the inner slightly exserted; the outer broadly expanded, widest on the inner lip, notched in the middle and reflected posterior to the notch over the umbilicus, which it completely covers. It is also marked by slender, concentric laminae. Operculum typically tudorid. There is a breathing puncture on the parietal wall near the posterior angle of the aperture.

This species ranges from Lagunillas de Consolación east to the Sierra de Güira, San Diego de los Baños.

We are recognizing three subspecies, which the accompanying key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF *TUDORA* (*EUTUDOREX*) *UNDOSA*

Spiral sculpture obsolete on last whorl.....	<i>laureani</i>
Spiral sculpture not obsolete on last whorl.	
Shell large, length more than 9 mm.....	<i>barroi</i>
Shell small, length less than 6 mm.....	<i>undosa</i>

TUDORA (*EUTUDOREX*) *UNDOSA LAUREANI*, new subspecies

PLATE 23, FIGURE 8

This race was collected by Laureano Pequeño at Mogote El Arabó, La Ceja near Lagunillas de Consolación, San Juan y Martinez. It differs from the other large member, *T. (E.) undosa barroi*, in having the spiral sculpture of the last whorl obsolete, and in being smaller and less elongate-conic. Here likewise the axial ribs are much more frequently gathered into tufts at the summit.

The type, U.S.N.M. No. 493422, a complete specimen, has 6.2 whorls and measures: Length, 9.1 mm.; greater diameter, 5.3 mm.; lesser diameter, 4.4 mm.

TUDORA (*EUTUDOREX*) *UNDOSA BARROI*, new subspecies

PLATE 23, FIGURE 7

This subspecies comes from the mogote lying about Kilometer 14 on the road between Pinar del Rio and Viñales. It is larger than any of the other races, and it is easily differentiated from *T. (E.) undosa laureani* by its more elongate form and strong spiral sculpture on the last whorl.

The type, U.S.N.M. No. 356468, a decollated specimen having 3.3 whorls, measures: Length, 9.4 mm.; greater diameter, 5.4 mm.; lesser diameter, 5.0 mm.

TUDORA (EUTUDOREX) UNDOSA UNDOSA ([Gundlach] Pfeiffer)

PLATE 23, FIGURE 4

1863. *Ctenopoma undosum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 10, pp. 193-194.

1867. *Cyclostoma undosum* ARANGO, Repert físico natural Isla de Cubana, p. 76.

1920. *Tudora (Tudorops) undosa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 77.

The typical subspecies occupies the Sierra de Güira and is much smaller than the other two.

A cotype, U.S.N.M. No. 356388, received from Gundlach, has 3.1 whorls remaining and measures: Length, 5.0 mm.; greater diameter, 4.0 mm.; lesser diameter, 3.1 mm. Its last whorl has 208 axial riblets

TUDORA (EUTUDOREX) PULVERULENTA ([Wright] Pfeiffer)

PLATE 23, FIGURE 5

1864. *Ctenopoma pulverulentum* [Wright] PFEIFFER, Malakozool. Blätter, vol. 11 pp. 103-104.

1867. *Cyclostoma pulverulentum* ARANGO, Repert físico natural Isla de Cubana, p. 76.

1920. *Tudora (Tudorops) pulverulenta* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 77.

Shell elongate-conic, slender, pale yellow with the peristome and interior of the aperture a little paler. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, marked by slightly retractively slanting axial riblets, of which 82 occur on the first whorl, 116 on the second, 142 on the third, and 178 on the last. These riblets develop into strong auricles at the summit, particularly so on the last turn, and these auricles are frequently fused in groups into denticles. The spiral sculpture is scarcely indicated; but the slight waviness of the ribs suggests this sculpture. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and by 6 spiral threads about the umbilicus. These spiral threads cover the umbilical half of the base and they are strongest near the umbilicus, where they render the axial riblets feebly scalloped. Aperture very broadly oval, almost circular; peristome double, the outer expanded, somewhat wavy and reflected over the umbilicus; the inner fusing with the outer, and indicated only at the posterior angle. Operculum typically tudorid.

The specimen described and figured, U.S.N.M. No. 356394, is a topotype received from Dr. de la Torre, collected by C. Wright at Isabel Maria, Pinar del Rio. It has a little over 4 whorls and measures: Length, 6.8 mm.; greater diameter, 3.6 mm.; lesser diameter, 2.7 mm. The species seems restricted to that locality.

TUDORA (EUTUDOREX) ROCAI, new species**PLATE 23, FIGURE 3**

Shell elongate-ovate, moderately large, flesh colored, with a yellowish tinge. Nuclear whorls decollated. Postnuclear whorls inflated, strongly rounded, marked by slender, retractively curved, wavy axial riblets, of which 137 are present on the last turn in the type. These riblets are developed into auricles at the summit, and they also tend to form projections at the periphery. On the early whorls these two elements interlock. These riblets are about half as wide as the spaces that separate them. The spiral sculpture is indicated by the waviness of the axial ribs. Suture very strongly constricted. Periphery inflated, strongly rounded. Base short, openly umbilicated, strongly rounded, marked by the continuation of the axial ribs, which here likewise are wavy and at the edge of the umbilicus it is marked by a spiral series of strong scallops, which grow consecutively weaker from the outer toward the inside. Two of these strong series of scallops are present at the edge of the umbilicus and four are apparent on the anterior half of the umbilical wall. Aperture almost circular; peristome double, the inner slightly exerted and slightly reflected; the outer broadly expanded, decidedly so on the inner lip, and marked by concentric laminae. On the parietal wall the outer peristome is adnate to the preceding turn. Operculum typically tudorid. A breathing pore is present on the parietal wall near the posterior angle, slightly within the edge of the peristome.

The type, U.S.N.M. No. 493424, was collected by Father Roca at Sitio de la Sierra, north side of the Sierra de San Andrés. It has 3.2 whorls remaining and measures: Length, 6.3 mm.; greater diameter, 4.0 mm.; lesser diameter, 3.7 mm.

This species is easily differentiated from other *Eutudorex* in that it lacks the notch on the outer peristome of the inner lip, and in that it has the peristome of the inner lip decidedly expanded.

TUDORA (EUTUDOREX) COMPLANATA, new species**PLATE 23, FIGURE 1**

Shell small, ovate, flesh colored, with a yellowish tinge. Nuclear whorls decollated. Postnuclear whorls very strongly inflated, strongly rounded, marked by vertical, wavy axial riblets, which are a little narrower than the spaces that separate them. Of these 178 are present on the last whorl. These riblets become slightly expanded at the summit, also on the early whorls at the periphery, where these two elements interlock. The intercostal spaces are bridged by slender, threadlike spiral elements which are much finer than the axial ribs. Suture profoundly constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, openly umbilicated, marked by the con-

tinuation of the axial riblets and by spiral threads equaling those of the spire. The edge of the umbilicus is marked by a strong spiral cord, while the umbilical wall itself is free of spiral sculpture. Aperture almost circular; peristome double, the inner slightly exerted; the outer evenly, moderately broadly expanded and marked by concentric laminae and adnate to the preceding turn at the parietal wall. There is a breathing pore on the parietal wall near the posterior angle of the aperture slightly within the peristome. Operculum typically tudorid.

The type, U.S.N.M. No. 493425, comes from El Palmarito; that is the north side of El Queque, near Viñales, Pinar del Rio Province. It has almost 3 whorls remaining and measures: Length, 4.5 mm.; greater diameter, 3.0 mm.; lesser diameter, 2.5. mm.

This species can be readily differentiated from *T. (E.) troscheli* by having the axial ribs of uniform strength instead of a double series.

TUDORA (EUTUDOREX) TROSCHELI (Pfeiffer)

Shell small, thin, semitranslucent, pale straw yellow. Nuclear whorls 1.5, forming a blunt apex, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, well rounded, marked by retractively slanting axial riblets, which are not all of the same strength, but several slightly weaker ones are separated by a little stronger element. These riblets, particularly the stronger ones, become slightly expanded into small auricles at the summit. The spiral sculpture consists of very slender threads, which cross the intercostal spaces but not the ribs. These threads differ in strength and spacing in the different subspecies. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial ribs, which here become much intensified, the stronger elements becoming decidedly lamellose; the fine spiral sculpture described for the spire is also present on the base; in addition to that, two considerably stronger spiral threads mark the outer limit of the umbilicus. The umbilical wall is marked by the continuation of the axial riblets. Aperture almost circular; peristome double, the inner slightly exerted; the outer rather broadly expanded and slightly reflected, marked by concentric laminae adnate to the preceding turn on the parietal wall. Operculum typically tudorid.

This species is confined to Pinar del Rio Province, where it appears to range from Pan de Azucar through Cayos de San Felipe and Viñales to the mogotes south of the Sierra de San Andrés.

We are recognizing four subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF *TUDORA* (*EUTUDOREX*) *TROSCHELI*

- Axial and spiral sculpture feeble..... *troscheli*
 Axial and spiral sculpture not feeble.
 Axial ribs strongly scalloped..... *azucarensis*
 Axial ribs not strongly scalloped.
 Spiral threads of intercostal spaces strongly developed... *antoniensis*
 Spiral threads of intercostal spaces poorly developed.. *palmaritensis*

***TUDORA* (*EUTUDOREX*) *TROSCHELI TROSCHELI* (Pfeiffer)**

PLATE 24, FIGURE 3

1864. *Choanopoma troscheli* PFEIFFER, Malakozool. Blätter, vol. 11, p. 103.
 1867. *Cyclostoma troscheli* ARANGO, Repert físico natural Isla de Cubana, p. 76.
 1920. *Tudora* (*Tudorops*) *troscheli* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 77.

The typical subspecies appears to be confined to Cayos de San Felipe, Pinar del Rio Province. It is differentiated from the others by its larger size and by its feeble axial and spiral sculpture.

A cotype, U.S.N.M. No. 356396, has 4 whorls remaining and measures: Length, 6.3 mm.; greater diameter, 4.2 mm.; lesser diameter, 3.1 mm.

***TUDORA* (*EUTUDOREX*) *TROSCHELI AZUCARENSIS*, new subspecies**

PLATE 24, FIGURE 4

This race comes from Pan de Azucar, Pinar del Rio Province. It is a very small race, with the axial ribs very strongly scalloped. In size it resembles *T. (E.) troscheli palmaritensis*, from which, however, it is easily distinguished by its strong sculpture.

The type, U.S.N.M. No. 493427, has 3 whorls remaining and measures: Length, 4.5 mm.; greater diameter, 2.7 mm.; lesser diameter, 2.4 mm.

***TUDORA* (*EUTUDOREX*) *TROSCHELI ANTONIENSIS*, new subspecies**

PLATE 24, FIGURE 1

This subspecies comes from Hoyo Largo de San Antonio, one of the mogotes off the south side of the Sierra de San Andrés, Pinar del Rio Province. The spiral threads of the intercostal spaces are very strongly developed, in which respect it differs from *T. (E.) troscheli palmaritensis*, from which it is also distinguished by its much larger size.

The type, U.S.N.M. No. 493429, has 3.1 whorls remaining and measures: Length, 5.0 mm.; greater diameter, 3.5 mm.; lesser diameter, 3.0 mm.

TUDORA (EUTUDOREX) TROSCHELI PALMARITENSIS, new subspecies

PLATE 24, FIGURE 2

This race comes from El Palmarito, that is, the north side of El Queque near Viñales. It is small, like *T. (E.) troscheli azucarensis*, from which it is readily distinguished by its much weaker sculpture and scarcely indicated scallops.

The type, U.S.N.M. No. 493431, has 3 whorls remaining and measures: Length, 4.6 mm.; greater diameter, 3.4 mm.; lesser diameter, 3.0 mm.

Subgenus RAMSDENIA Preston

1913. *Ramsdenia* PRESTON, Proc. Malac. Soc. London, vol. 10, p. 323.

Shell small, elongate-conic. Nuclear whorls forming a subglobular apex followed by one or more turns, which are decidedly solutely coiled, resembling a corkscrew, after which the normal coiling is resumed. Most of the shells gathered are decollated at the termination of the solute portion. The whorls are marked by slender, sublamellar, wavy axial riblets, which are usually auriculated at the summit. Scallops may also be present at intervals on the ribs of the spire and the periphery may have strong scallops, which may interdigitate with those at the summit of the whorls. Fine spiral lirations may or may not be present on the spire. The base also may or may not have spiral cords. The umbilicus, however, is always provided with spiral cords. The last whorl is solute. The axis of the shell is hollow. Peristome double, the outer with a channel at the posterior angle, which forms an auricle. Operculum rather large, capping the aperture. Chondroid plate decidedly concave, that is, its outer margin inward bent. Calcareous lamella broadly expanded and curved to form one continuous sheet of rounded whorls, which are marked by retractively curved, slender threads.

Type: *Tudora (Ramsdenia) nobilitata mirifica* (Preston).

KEY TO THE SPECIES OF THE SUBGENUS RAMSDENIA

Fine spiral sculpture present.....	nobilitata
Fine spiral sculpture absent.	
Axial ribs coarse and decidedly lamellose.....	bufo
Axial ribs not coarse or decidedly lamellose.	
Axial ribs sublamellose.	
Periphery with a dark chestnut band.....	notata
Periphery without a dark chestnut band.....	natensoni
Axial ribs obsolete.....	perspectiva

TUDORA (RAMSDENIA) NOBILITATA ([Gundlach] Poey)

Shell small, elongate-conic, milk white. Nuclear whorls 2, forming a subglobular apex, well rounded, microscopically granulose, with the

last portion of the last whorl showing the beginning of the postnuclear sculpture. The first two postnuclear whorls are very solutely coiled, the first one being marked by distantly spaced, wavy axial riblets; the rest, which are inflated and strongly rounded, are marked by sinuous, almost vertical axial ribs, which on the last whorl are a little narrower than the spaces that separate them. Some of the axial riblets are expanded into hollow auricles at the summit. The intercostal spaces are marked by numerous, somewhat irregularly spaced, fine spiral lirations, which vary much in strength in the different subspecies. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, narrowly, openly umbilicated, marked by the continuation of the wavy axial riblets. Last whorl solute for a fraction of a turn. The umbilical wall is marked by the continuation of the axial riblets and by spiral threads, which vary in strength and number in the different races; the junctions of the axial ribs and spiral cords form nodules or scallops. Aperture circular; peristome double, the inner slightly exerted above the outer; the outer very narrowly expanded. Operculum typically ramsdenid.

This species comes from Oriente Province, where it breaks up into the following subspecies:

KEY TO THE SUBSPECIES OF TUDORA (RAMSDENIA) NOBILITATA

Spiral lirations on spire conspicuous.

Spiral cords on the umbilical wall few and strong..... nobilitata

Spiral cords on the umbilical wall many and weak..... mirandensis

Spiral lirations on spire inconspicuous

Spiral cords on the umbilical wall strong..... mirifica

Spiral cords on the umbilical wall not strong.

Shell small and slender..... yaterasensis

Shell large and stout..... mayariensis

TUDORA (RAMSDENIA) NOBILITATA NOBILITATA ([Gundlach] Poey)

PLATE 24, FIGURES 5, 8

1858. *Cyclostoma nobilitatum* [Gundlach] POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, p. 87.

1862. *Ctenopoma nobilitatum* PFEIFFER, Malakozool. Blätter, vol. 9, p. 3.

1920. *Ramsdenia nobilitatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus. vol. 58, p. 79.

The typical subspecies was collected by Gundlach at Enramadas (San Luis), north of Santiago, Oriente Province.

It is a small race in which the spiral lirations are conspicuous and the auricles at the summit interlock with denticles projecting downward from the periphery. The specimen, U.S.N.M. No. 355666, which has served for our description and figure, is a paratype collected by Gundlach at the type locality. It has 3 whorls remaining, which

bear 67 axial ribs on the first, 94 on the second, and 103 on the third. In addition to these ribs, the base has three weak spiral cords, and the umbilical wall bears 7 strong cords on its anterior two-thirds; these cords render the axial riblets decidedly scalloped. The specimen figured measures: Length, 5.5 mm.; greater diameter, 3.2 mm.; lesser diameter, 3.0 mm.

TUDORA (RAMSDENIA) NOBILITATA MIRANDENSIS, new subspecies

PLATE 24, FIGURE 7

This subspecies was collected by Dr. Pilsbry at Tibisi near Miranda, Oriente Province.

This race agrees with *T. (R.) nobilitata nobilitata* in the strength of its spiral lirations of the spire, but it is easily distinguished from *nobilitata* by its larger size and much more numerous and finer spiral cords on the umbilical wall.

The type, U.S.N.M. No. 535667, has 3.8 whorls remaining and measures: Length, 10.0 mm.; greater diameter, 3.9 mm.; lesser diameter, 3.7 mm. The first of these whorls has 54 axial riblets, the second 82, the third 102, and the last eight-tenths of a whorl has 94 axial riblets. The base is marked by four feeble spiral threads, and the umbilical wall has 14.

TUDORA (RAMSDENIA) NOBILITATA MIRIFICA (Preston)

PLATE 24, FIGURES 6, 9

1913. *Choanopoma (Ramsdenia) mirifica* PRESTON, Proc. Malac. Soc. London, vol. 10, p. 323, figured.

1920. *Ramsdenia mirifica* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

This subspecies was collected by Dr. Ramsden at Bayate near Concepcioncita, northwest of Guantánamo, Oriente Province. It belongs to the group in which the spiral lirations are inconspicuous, and the spiral cords on the umbilical wall are few and strong.

The specimen described and figured, a cotype, U.S.N.M. No. 356482, has 3 whorls remaining, of which the first has 86 riblets, the second 97, and the last 114. The axial riblets terminate in conspicuous auricles at the summit and interlock with denticles at the periphery of the preceding turn. The base has mere indications of spiral threads, while the umbilical wall shows 6 strong cords. The specimen figured measures: Length, 5.9 mm.; greater diameter, 3.5 mm.; lesser diameter, 3.0 mm.

TUDORA (RAMSDENIA) NOBILITATA YATERASENSIS, new subspecies**PLATE 25, FIGURE 4**

This race comes from the Yateras region, northeast of Guantánamo, Oriente Province. It is a small slender race, in which the spiral lirations are inconspicuous and the spiral cords on the umbilical wall are weak.

The type, U.S.N.M. No. 356484, has 3.2 whorls remaining, of which the first bears 90 axial riblets, while the last has 124. The base shows only the merest indications of spiral threads, and the umbilical wall is marked by 8 very feeble cords, which render the axial riblets weakly nodulose. The type measures: Length, 5.9 mm.; greater diameter, 3.2 mm.; lesser diameter, 2.8 mm.

TUDORA (RAMSDENIA) NOBILITATA MAYARIENSIS, new subspecies**PLATE 25, FIGURE 3**

This is the largest of all the races. The type, U.S.N.M. No. 535669, was collected by Wright at Piloto Arriba, Mayarí, Oriente Province. It has 3.2 whorls remaining, of which the first bears 102 riblets, the second 121, and the third, which is a little more than two-tenths of a turn, bears 123. The spiral sculpture on the base is too feeble to be definitely described, and the umbilicus bears 7 weak cords. The type measures: Length, 6.7 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.2 mm. The large size and stout shape will easily differentiate this from the other subspecies.

TUDORA (RAMSDENIA) BUFO (Pfeiffer)**PLATE 25, FIGURE 2**

1864. *Ctenopoma? bufo* PFEIFFER, Malakozool. Blätter, vol. 11, p. 104.

1865. *Ctenopoma bufo* PFEIFFER, Monographia pneumonopomorum viventium, Suppl. 2, pp. 113-114.

1867. *Cyclostoma bufo* ARANGO, Repert físico natural Isla de Cubana, p. 74.

1920. *Ramsdenia bufo* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

Shell elongate-conic, pale yellow. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by lamellar, slightly retractively slanting, hollow axial riblets, of which 62 occur on the first, 76 on the second, and 88 on the last of the remaining turns. These riblets are developed into strong auricles at the summit. The spiral sculpture consists of broad, low, rounded threads, which render the axial riblets conspicuously scalloped at their junctions. Five of these threads occur on the first of the remaining turns, and 6 are on the last. Suture strongly constricted. Periphery well rounded. Base short, well rounded, narrowly, openly umbilicated, marked by the

continuation of the axial riblets and by 4 broad spiral threads, which render the axial riblets conspicuously scalloped at their junction. The umbilical wall is marked by the feeble continuation of the axial riblets and by 12 spiral threads; here, also, the combination of the two forms feeble scallops. Last whorl solute for one-tenth of a turn. Aperture subcircular; peristome double, the inner moderately exerted; the outer moderately, broadly expanded, a little wider on the inner lip and the parietal wall than on the outer and basal lip, marked by concentric lamina. Operculum typically ramsdenid.

U.S.N.M. No. 356490 contains 2 specimens from the type locality, Malaño Cave, Oriente Province, one of which we have figured. It has a little over 3 whorls and measures: Length, 6.8 mm.; greater diameter, 4.1 mm.; lesser diameter, 3.6 mm. The other specimen has a little over 3 whorls and measures: Length, 6.9 mm.; greater diameter, 4.5 mm.; lesser diameter, 3.8 mm. In one of these specimens the first postnuclear whorl is slightly solute, showing the typical solute characteristic of *Ramsdenia*.

The exceedingly strong, hollow lamellose ribs will distinguish this species from all other Ramsdenias.

TUDORA (RAMSDENIA) NOTATA, new species

PLATE 25, FIGURES 5, 8

Shell elongate-conic, flesh colored, with a conspicuous spiral band of brown a little posterior to the middle of the base. Nuclear whorls 2, forming a subglobular apex, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. The first two postnuclear whorls are very strongly solute, corkscrew-shaped, the first one marked by distantly spaced, lamellar axial riblets; the rest of the postnuclear whorls inflated, strongly rounded, marked by sinuous, rather closely spaced, sublamellar axial riblets, of which 84 occur on the first of the remaining turns, 126 on the second, and 142 on the last. Some of these riblets are expanded into hollow auricles at the summit. The spaces between the axial riblets are not marked by incised spiral lines, but are granular. Suture strongly constricted. Periphery inflated, well rounded. Base short, well rounded, marked by the continuation of the sinuous axial riblets and by 2 spiral threads, one of which is on the middle and the other marks the junction of the umbilical wall with the base. The spiral cords render the axial riblets conspicuously scalloped. The umbilical wall is marked by the continuation of the feeble axial riblets and by 3 spiral threads; the junction of these with the axial riblets renders them feebly scalloped. Last whorl solute for one-third of a turn. Aperture subcircular; peristome double, the inner moderately exerted; the outer

broadly, flaringly expanded, more so on the outer lip than on the inner, reflected into a sinus at the posterior angle, and marked by concentric laminae. Operculum typically ramsdenid.

The type, U.S.N.M. No. 356488, was collected by Mr. Henderson at Camayén, Santa Lucía, Oriente Province. It has a little over 3 whorls and measures: Length, 6.2 mm.; greater diameter, 4.3 mm.; lesser diameter, 3.3 mm.

TUDORA (RAMSDENIA) NATENSONI, new species

Shell small, elongate-conic, thin, semitranslucent, flesh colored, with the scallops white. Nuclear whorls 2, strongly rounded, forming a globular apex. The first 1.5 turns of the postnuclear whorls are solute; the rest of the postnuclear whorls are somewhat inflated, well rounded, and marked by sublamellar axial riblets, which appear more or less in series, that is, several stronger riblets will be succeeded by several weaker ones, giving the shell a somewhat scalariform aspect. These axial riblets are conspicuously expanded into auricles at the summit. There are also several rows of scallops on the axial riblets of the spire, which are arranged in spiral series. These scallops may be hollow. The peripheral series not infrequently interlocks with those at the summit of the succeeding whorls. Suture strongly constricted. Periphery rendered slightly angulated by the scallops referred to. Base well rounded, marked by three rows of scallops. The last whorl is solute for a fraction of a turn; it is openly umbilicated and marked by the continuation of the axial ribs and spiral cords. Aperture circular; peristome double, the inner slightly exserted; the outer rather broadly expanded all around and conspicuously scalloped at the edge, forming a conspicuous auricle at the posterior angle, which is channeled and backward reflected, marked by a series of concentric lamellae. Operculum typically ramsdenid.

This species comes from the north coast of Oriente Province.

KEY TO THE SUBSPECIES OF TUDORA (RAMSDENIA) NATENSONI

Shell slender.....	natensoni
Shell stout.....	canetensis

TUDORA (RAMSDENIA) NATENSONI NATENSONI, new subspecies

PLATE 25, FIGURE 9

Natenson collected the typical subspecies at Finca El Retiro (de Silva), and San Alejo, Boca de Taco, Nibujón, west of Baracoa, Oriente Province. It differs from *T. (R.) natensoni canetensis* in being much more slender, and in having the axial ribs much more scalariform.

The type, U.S.N.M. No. 535670, comes from Finca El Retiro. It has 4.3 whorls remaining and measures: Length, 8.3 mm.; greater

diameter, 5.0 mm.; lesser diameter, 4.0 mm. There are 53 riblets present on the first whorl, 67 on the second, 77 on the third, 120 on the fourth, and 69 on the last three-tenths of a whorl.

TUDORA (RAMSDENIA) NATENSONI CANETENSIS, new subspecies

PLATE 25, FIGURE 7

Natenson collected this race at Cañete, west of Taco, west of Baracoa, Oriente Province.

It differs from the typical race in being much larger, stouter, and in having the axial ribs not as conspicuously scalariform. The type, U.S.N.M. No. 535673, has 4.2 whorls remaining and measures: Length, 8.9 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.3 mm. It has 44 riblets on the first whorl, 76 on the second, 128 on the third, and 129 on the last and the fraction remaining.

TUDORA (RAMSDENIA) PERSPECTIVA ([Gundlach] Pfeiffer)

PLATE 25, FIGURES 1, 6

1859. *Cyclostoma perspectivum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6, p. 72.
1865. *Ctenopoma perspectivum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, pp. 116-117.
1915. *Rhytidopoma perspectivum* PILSBRY, Nautilus, vol. 28, p. 136.
1920. *Ramsdenia perspectivum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

Shell elongate-conic, pale horn colored. Nuclear whorls 2, forming a subglobular apex, the whorls of which are well rounded and microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. The first two post-nuclear turns are solute, very openly and broadly coiled, and marked by rather distantly spaced, retractively slanting, axial riblets; the later turns are strongly rounded and marked by slightly retractively curved, axial riblets which are very poorly developed and tend to become obsolete on the last whorl. The stronger of these riblets are developed into conspicuous auricles at the summit. In the specimen described and figured, 108 of these ribs are present on the next to the last whorl and 136 on the last. Suture strongly constricted. Periphery well rounded. There is an indication of a feeble spiral thread immediately below the periphery and two additional strong spiral cords on the base render the axial riblets strongly scalloped at their junction. The umbilicus is broadly open, and the umbilical wall is marked by the feeble continuation of the axial riblets and 3 obsolete spiral threads, which also render the axial riblets scalloped. Last whorl solute for about one-half a turn. Aperture subcircular; peristome double, the outer strongly fimbriated, the strongest fim-

briation marking the posterior angle, a little broader on the outer lip than on the rest; inner peristome slightly exserted. Operculum typically ramsdenid.

The specimen described and figured is a cotype, U.S.N.M. No. 356491, collected by Gundlach at Monte Toro, Guantánamo, Oriente Province, and presented to the U. S. National Museum by Dr. de la Torre. It has 3 whorls and measures: Length, 7.4 mm.; greater diameter, 4.9 mm.; lesser diameter, 3.9 mm.

Of the animal Gundlach says (Malakozool. Blätter, vol. 6, p. 72, 1859): "On stones. Animal whitish with white dots which become fused into spots on the foot. Head and middle of antennae ochre colored. Tip of antennae blackish."

GUNDLACHTUDORA, new subgenus

Helicoid tudorids having the spiral sculpture stronger than the axial. Peristome decidedly thickened and transversely fluted. Operculum with the calcareous lamella reflected to touch that of the succeeding whorl; lamella marked with oblique threads.

Type: *Tudora* (*Gundlachtudora*) *decolorata* ([Gundlach] Pfeiffer).

TUDORA (GUNDLACHTUDORA) DECOLORATA ([Gundlach] Pfeiffer)

PLATE 28, FIGURE 3

1859. *Cyclostoma decoloratum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6, p. 70.
 1863. *Cyclostoma decoloratum* REEVE, Conchologia iconica, no. 150.
 1865. *Choanopoma decolorata* PFEIFFER, Monographia pneumonopomorum viventium, Suppl. 2, p. 107.
 1920. *Tudora* (*Tudorellata*) *decolorata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 76.

Shell subglobular, yellowish white. Nuclear whorls 2, forming an almost mucronate apex, well rounded, microscopically granulose, except for the last portion of the last whorl, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by slightly retractorily slanting, wavy axial riblets, and by spiral threads which are a little stronger than the axial riblets. Of these, 5 occur on the first, 7 on the second, and 10 on the last between the summit and suture. The spiral threads render the axial riblets strongly wavy. Suture strongly constricted. Periphery inflated, well rounded. Base short, openly umbilicated, strongly rounded, marked by the continuation of the axial riblets and by 8 spiral threads, which are as strong as those on the spire. The axial riblets extend into the umbilicus, where they become closely crowded. On the umbilical wall there are 9 spiral threads, which are stronger than those on the base. Last whorl solute for a fourth of a turn. Aperture broadly oval; peristome double, the inner slightly exserted and slightly

reflected, almost fusing with the outer; the outer very much thickened, broadly expanded and decidedly fluted all around. Operculum with subcentral depressed nucleus and a broad calcareous lamella, which is reflected to parallel the chondroid plate on the last turn, and which forms a continuous surface on the outside.

This species was described from Monte Toro, Guantánamo, Oriente Province.

The specimen described and figured is one of two, U.S.N.M. No. 356345, received from Poey. It has a little over 4 whorls and measures: Length, 9.7 mm.; greater diameter, 9.8 mm.; lesser diameter, 7.5 mm. The other specimen has a little over 4 whorls and measures: Length, 8.1 mm.; greater diameter, 8.7 mm.; lesser diameter, 6.6 mm.

Gundlach states of this species (Malakozool. Blätter, vol. 6, p. 70, 1859): "Animal whitish with white dots above which become fused into spots. Head with olive colored suffusion and dark dots, reddish within. Feelers cinnabar red with thickened brownish apex. The first turn of the animal appears greenish through the substance of the shell."

AGUAYOTUDORA, new subgenus

Shell varying from elongate-ovate to elongate-conic. Nuclear whorls microscopically granulose. Postnuclear whorls marked by axial ribs and by spiral threads, both of which elements vary materially in strength in the different species. The axial ribs may or may not be gathered into tufts or they may or may not form cusps at the summit. There is no siphon or breathing pore. Peristome simple. Operculum typically tudorid.

Type: *Tudora* (*Aguayotudora*) *aguayoi*, new species.

KEY TO THE SPECIES OF THE SUBGENUS AGUAYOTUDORA

Axial ribs exceedingly fine.....	<i>suavis</i>
Axial ribs not exceedingly fine.	
Axial ribs gathered into broad tufts.....	<i>cristata</i>
Axial ribs not gathered into broad tufts.	
Axial ribs obsolete on last whorl.....	<i>crassiuscula</i>
Axial ribs not obsolete on last whorl.	
Axial ribs expanding into hollow cusps at the summit.	
Shell elongate-conic.....	<i>bermudezi</i>
Shell ovate.....	<i>recta</i>
Axial ribs not expanding into hollow cusps at the summit.	
Axial ribs decidedly scalloped.....	<i>asperata</i>
Axial ribs not decidedly scalloped.	
Axial ribs tuberculate.....	<i>tuberculata</i>
Axial ribs not tuberculate.	
Axial ribs very regular.....	<i>aguayoi</i>
Axial ribs irregular.	
Umbilicus broad.....	<i>varicosa</i>
Umbilicus narrow.....	<i>obesa</i>

TUDORA (AGUAYOTUDORA) SUAVIS, *new species*

PLATE 26, FIGURE 5

Shell elongate-ovate, varying from pale yellow to pale brown, sometimes with a brown band at the suture. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, marked by very closely spaced, low, rounded axial riblets, which are separated by spaces about as wide as the riblets. There are 431 of these on the last whorl. The riblets do not form cusps at the summit. The spiral sculpture is absent on the spire. Suture strongly constricted. Periphery of the last whorl well rounded. Base short, well rounded, marked by the continuation of the axial ribs and by 5 almost obsolete spiral cords, which grow successively a little stronger from the periphery toward the umbilicus. The umbilicus is broad and open and its wall bears 8 spiral cords, which grow successively stronger from within toward the outside. The axial riblets cross these spiral cords and their interspaces. Last whorl solute for about one-fifth of a turn. Aperture broadly oval; peristome simple, slightly auriculated at the posterior angle. Operculum typically tudorid.

The type, U.S.N.M. No. 493432, comes from Guaicanamar, Camagüey Province. It has 6.5 whorls and measures: Length, 12.1 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.8 mm.

This species is easily distinguished from all the other *Aguayotudoras* by its fine ribbing.

TUDORA (AGUAYOTUDORA) CRISTATA, *new species*

Shell thin, elongate-ovate, pale brown, with interrupted spiral bands of chestnut brown. Nuclear whorls 2, inflated, well rounded, microscopically granulose, forming a rather small apex. Postnuclear whorls inflated, rather high between summit and suture, marked by retractorily curved axial ribs, which form conspicuous scallops at the summit, where frequently several of them are fused together to form a tuft. On the early turns the axial riblets become expanded also into scallops at the periphery where they interlock with those at the summit of the succeeding turns. The spiral sculpture is obsolete or very poorly developed. Suture strongly constricted. Periphery of the last whorl well rounded. Here the scallops mentioned for the early turns are absent. Base short, well rounded, with a mere umbilical chink, but without apparent perforation, marked by spiral cords, which are low and broad anteriorly, and which become stronger toward the umbilicus, where they render the axial ribs weakly scalloped. The exposed portion of the umbilical wall shows slender spiral threads, which also form minute scallops at their junction with the

axial ribs. Aperture broadly oval; peristome simple, auriculated at the posterior angle. Operculum typically tudorid.

This species is confined to Camagüey Province. We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF *TUDORA* (AGUAYOTUDORA) *CRISTATA*

Spiral sculpture of last whorl obsolete..... *cristata*
Spiral sculpture of last whorl consisting of low rounded threads... *chorrillensis*

TUDORA (AGUAYOTUDORA) *CRISTATA CRISTATA*, new subspecies

PLATE 26, FIGURE 4

This subspecies comes from San Martín de Biaya, 15 miles south of Martí, Camagüey Province. It is easily distinguished from *T. (A.) cristata chorrillensis* in lacking the spiral threads on the last whorl.

The type, U.S.N.M. No. 493434, has 6.5 whorls and measures: Length, 12.8 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.7 mm.

There is considerable variation in size of individuals of this subspecies. The smallest specimen has 6.2 whorls and measures: Length, 9.6 mm.; greater diameter, 5.7 mm.; lesser diameter, 4.9 mm.

TUDORA (AGUAYOTUDORA) *CRISTATA CHORRILLENSIS*, new subspecies

PLATE 26, FIGURE 6

This subspecies comes from the Vereda del Telégrafo, Sierra del Chorrillo, south-southeast of Camagüey, Camagüey Province. It is readily distinguished from *T. (A.) cristata cristata* by the fact that the whorls have low rounded spiral threads, which render the axial ribs slightly sinuous. The spiral sculpture on the base is also much more pronounced.

The type, U.S.N.M. No. 493436, has lost the nuclear turns, the 5 postnuclear whorls measuring: Length, 13.3 mm.; greater diameter, 7.4 mm.; lesser diameter, 6.3 mm.

TUDORA (AGUAYOTUDORA) *CRASSIUSCULA*, new species

PLATE 26, FIGURE 7

Shell ovate, horn yellow, with interrupted spiral bands of brown. The elements composing these bands are rather distantly spaced and are arranged also in axial series. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls very inflated, strongly rounded, marked by retractively slanting axial ribs which are best developed on the early whorls and which become decidedly enfeebled, in fact almost obsolete, on the last turn. These riblets are distantly spaced on the early turns, but they become more

closely approximated on the later whorls, where they develop into strong cusps at the summit, which are very variable in strength. At the periphery on the early turns they also become strengthened into elongate, scalloplike elements. The spiral sculpture is indicated by a few threads on the first turn, but disappears on the succeeding turns. Suture well constricted. Periphery of the last whorl strongly inflated and rounded. Base short, openly umbilicated, inflated, strongly rounded, and marked by the continuation of the axial ribs and by a spiral cord at the outer edge of the umbilicus. There is the merest indication of a second cord a little posterior to this. The exposed portion of the umbilical wall is marked by 10 equally strong and equally spaced spiral cords, of which only the outer one is a little heavier than the rest. Aperture subcircular; peristome simple. Operculum typically tudorid.

The type, U.S.N.M. No. 493438, comes from Palomar de San José, Sierra de Guaicanamar, Camagüey Province. It has 6.2 whorls and measures: Length, 13.0 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.3 mm.

We also have specimens from La Caridad de Guerrero, Sierra de Guaicanamar.

TUDORA (AGUAYOTUDORA) BERMUDEZI, new species

Shell elongate-ovate, thin, pale horn colored, with interrupted spiral bands of brown. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose. Postnuclear whorls high between the summit and suture, rather strongly inflated, marked by retractively curved, rather distantly spaced axial ribs, which are expanded into scallops at the summit and on the early turns, slightly thickened at the periphery, where they form weak interlocking elements with the scallops at the summit of the succeeding turn. Spiral sculpture absent on the spire. Suture constricted. Periphery well rounded. Base moderately long, narrowly, openly umbilicated, marked by the continuation of the axial ribs and on the umbilical wall by spiral threads, which become a little stronger toward the edge of the umbilicus than within. Last whorl solute. Aperture broadly oval; peristome simple. Operculum typically tudorid.

The species appears limited to Camagüey Province.

We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF TUDORA (AGUAYOTUDORA) BERMUDEZI

Shell stout.....	bermudezi
Shell slender.....	sibanicuensis

TUDORA (AGUAYOTUDORA) BERMUDEZI BERMUDEZI, new subspecies

PLATE 26, FIGURE 8

This subspecies comes from La Caridad, on the road southeast of Camagüey, Camagüey Province. It differs from *T. (A.) bermudezi sibanicuensis* in being much larger and stouter.

The type, U.S.N.M. No. 493441, has 5.3 whorls remaining and measures: Length, 14.0 mm.; greater diameter, 7.3 mm.; lesser diameter, 6.1 mm.

TUDORA (AGUAYOTUDORA) BERMUDEZI SIBANICUENSIS, new subspecies

PLATE 26, FIGURE 9

This subspecies was collected by Bermudez at Finca San Pablo near Sibanicú, Camagüey Province. It differs from *T. (A.) bermudezi bermudezi* in being much smaller and much more slender.

The type, U.S.N.M. No. 493442, has 4.5 whorls remaining and measures: Length, 10.7 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.0 mm.

TUDORA (AGUAYOTUDORA) RECTA ([Gundlach] Pfeiffer)

Shell ovate, varying in color from flesh colored to pale brown, marked with interrupted spiral bands of brown. Nuclear whorls 2, inflated, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, marked by axial ribs, which vary materially in strength in the different races, not infrequently with a finer thread between the stronger ribs. The summits of the stronger axial ribs are expanded into hollow auricles and in the early whorls the axial ribs are also expanded at the periphery, forming an interlocking element in the suture with the auricles at the summit. In some of the races the axial ribs are somewhat sinuous and slightly nodulose. Suture well constricted. Periphery inflated, well rounded. Base moderately, broadly, openly umbilicated, marked by the continuation of the axial ribs. The umbilical wall bears spiral threads, which render the axial ribs nodulose, particularly so near the outer limit of the umbilicus. The last whorl is solute for a varying distance. Aperture broadly oval, with more or less of a carina at the posterior angle; peristome simple. Operculum typically tudorid.

The species is restricted to Camagüey Province. We are recognizing three subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF TUDORA (AGUAYOTUDORA) RECTA

Auricles at the summit closely spaced.

Axial ribs closely spaced..... *martiensis*

Axial ribs distantly spaced..... *barreti*

Auricles at the summit not closely spaced..... *recta*

TUDORA (AGUAYOTUDORA) RECTA MARTIENSIS, new subspecies

PLATE 26, FIGURE 1

This subspecies was collected by Dr. Rodriguez at Finca San Carlos, near the town of Marti, Camagüey Province. It resembles the typical race, but differs markedly from this by its much more uniform development of ribs and much greater number of auricles at the summit of the whorls. The nodulation of the axial ribs here is also much more pronounced.

The type, U.S.N.M. No. 493446, has 5.5 whorls and measures: Length, 10.2 mm.; greater diameter, 5.7 mm.; lesser diameter, 5.0 mm.

TUDORA (AGUAYOTUDORA) RECTA BARRETI, new subspecies

PLATE 26, FIGURE 2

This subspecies comes from Maraguán, Rio Hondo, about 13 miles southeast of Camagüey, Camagüey Province. It differs from the other two races in being much larger, with the axial ribs much more distantly spaced, and with the auricles at the summit strongly developed, in which respect it resembles *T. (A.) recta martiensis*.

The type, U.S.N.M. No. 493444, has lost the early whorls. The 4.2 turns remaining measure: Length, 12.7 mm.; greater diameter, 7.5 mm.; lesser diameter, 6.2 mm.

TUDORA (AGUAYOTUDORA) RECTA RECTA ([Gundlach] Pfeiffer)

PLATE 26, FIGURE 3

1863. *Cyclostomus rectus* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 10, p. 194.

1890. *Colobostylus rectus* CROSSE, Journ. Conchyl., vol. 38, p. 303.

1920. *Tudora (Tudorisca) recta* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 76.

The typical subspecies was collected by Gundlach between Las Tunas and Puerto Principe, Camagüey Province. It resembles most nearly *T. (A.) recta martiensis*, from which it is easily distinguished, however, by the fact that the differentiation into the stronger and weaker elements of the axial ribs is much more pronounced; the axial ribs therefore are much more irregular; also the auricles at the summit are much less frequently developed than in *T. (A.) recta martiensis*.

The specimen described and figured, U.S.N.M. No. 356367, a cotype, has 6 whorls and measures: Length, 10.2 mm.; greater diameter, 6.0 mm.; lesser diameter, 4.8 mm.

TUDORA (AGUAYOTUDORA) ASPERATA, new species

PLATE 27, FIGURE 5

Shell elongate-ovate, white. Nuclear whorls 2, inflated, strongly rounded, forming a small mammillated apex. Postnuclear whorls inflated, strongly rounded, and marked by lamellar axial ribs, between which 1 or 2 finer axial ribs may be present. The lamellar ribs are decidedly scalloped, having the appearance of being rendered so by the spiral cords, which are not present in the intercostal spaces. Five of these scallops are present between summit and the periphery. The scallops at the periphery and the expanded riblets at the summit of the succeeding turns interlock on the early turns. Suture strongly constricted. Periphery well rounded. Base short, narrowly, openly umbilicated, marked by the continuation of the axial ribs, which bear 3 scallops. The umbilical wall also bears the continuation of the axial ribs and 4 feeble threads on the exposed portion. Last whorl slightly solute. Aperture very broadly oval, almost circular, peristome simple. Operculum typically tudorid.

The type, U.S.N.M. No. 493448, comes from El Cacaotal in the Sierra de Najaza. It has 6.2 whorls and measures: Length, 12.8 mm.; greater diameter, 6.9 mm.; lesser diameter, 5.3 mm.

The strong scallops on the ribs differentiate this at a glance from all the other Aguayotudoras.

TUDORA (AGUAYOTUDORA) TUBERCULATA, new species

PLATE 27, FIGURE 2

Shell elongate-ovate, varying in color from flesh colored to chestnut-brown. The paler forms show conspicuous, interrupted spiral bands of brown. Nuclear whorls decollated in all our specimens. Post-nuclear whorls strongly inflated, marked by retractively curved axial riblets, which are not all of the same strength; heavier ones are interspersed with 1 or 2 finer elements. The axial ribs are tuberculated, but no spiral threads appear to be present in the intercostal spaces. The tubercles are best developed on the early whorls, 6 being present between summit and suture on the second, and 7 on the third. On the last whorl they become enfeebled. Suture strongly constricted. Periphery inflated, well rounded. Base short, inflated, strongly rounded, broadly, openly umbilicated, marked by the continuation of the axial ribs and by 3 rows of tubercles, which here almost constitute spiral threads. The umbilical wall has 10 spiral threads, which render the axial ribs nodulose. The last whorl is solute for a tenth of a turn. Aperture broadly oval; peristome simple. Operculum typically tudorid.

The type, U.S.N.M. No. 493474, comes from the Vereda del Telégrafo, Sierra del Chorrillo. It has 4.4 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.6 mm.

This species is easily distinguished from all the other *Aguayotudoras* by its granulose sculpture.

TUDORA (AGUAYOTUDORA) AGUAYOI, new species

Shell varying in shape from elongate-ovate to broadly ovate and in color from horn yellow to pale chestnut-brown, unicolor, or interruptedly spirally banded. Nuclear whorls 2, strongly rounded, microscopically granulose. Postnuclear whorls decidedly inflated, strongly rounded, marked by axial ribs which vary materially in strength; some are lamellar, while between them 1 or 2 finer threads may be present. The axial ribs are expanded into auricles at the summit and are thickened at the periphery, where in the early whorl they form interlocking elements. The axial ribs may or may not be nodulose, depending upon the race in question. Suture strongly constricted. Periphery inflated, well rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs, and by an indication of 1 or 2 feeble spiral threads adjacent to the open umbilicus. The umbilical wall is marked by the continuation of the axial ribs and by spiral threads, which render the ribs nodulose. Last whorl adnate or slightly solute. Aperture very broadly oval, with a decided auricle at the posterior angle; peristome simple. A shelf, which almost suggests a double peristome, limits the peristome at the posterior angle.

This species appears to be restricted to Camagüey Province.

We are recognizing 3 subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF TUDORA (AGUAYOTUDORA) AGUAYOI

Shell broadly ovate.....	aguayoi
Shell elongate-ovate.....	
Axial ribs distantly spaced.....	guaicanamarensis
Axial ribs closely spaced.....	najazaensis

TUDORA (AGUAYOTUDORA) AGUAYOI AGUAYOI, new subspecies

PLATE 27, FIGURE 7

This subspecies comes from Guaicanamar. We have seen it also from Palomar de San José, Guaicanamar, Camagüey Province. It is easily distinguished from the other two by its broadly ovate form and its slightly more open umbilicus.

The type, U.S.N.M. No. 493476, comes from the Sierra de Guaicanamar. It has 6.6 whorls remaining and measures: Length, 13.7 mm.; greater diameter, 8.2 mm.; lesser diameter, 6.8 mm.

TUDORA (AGUAYOTUDORA) AGUAYOI GUAICANAMARENSIS, new subspecies

PLATE 27, FIGURE 1

This subspecies comes from La Caridad de Guerrero, Sierra de Guaicanamar, Camagüey Province. We have seen it also from La Sierrita, Sierra de Guaicanamar, Camagüey Province. Its slender form easily distinguishes it from the typical race and the much more distantly spaced ribs distinguish it from *T. (A.) aguayoi najazaensis*.

The type, U.S.N.M. No. 493478, has 7 whorls and measures: Length, 13.2 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.9 mm.

TUDORA (AGUAYOTUDORA) AGUAYOI NAJAZAENSIS, new subspecies

PLATE 27, FIGURE 3

This subspecies comes from El Cacacaotal, Sierra de Najaza, Camagüey Province. This race resembles *T. (A.) aguayoi guaicanamarensis*, but differs from it in having the last whorl solute and the axial ribs more numerous and more closely spaced and rather conspicuously nodulose on the early turns.

The type, U.S.N.M. No. 493480, has 7.1 whorls and measures: Length, 12.7 mm.; greater diameter, 6.5 mm.; lesser diameter, 5.6 mm.

TUDORA (AGUAYOTUDORA) VARICOSA, new species

PLATE 27, FIGURE 8

Shell broadly oval, thin, pale yellow, with very broad, interrupted spiral bands of brown, and with a broad chestnut-colored band at the summit. Nuclear whorls decollated in all our specimens. Post-nuclear whorls very strongly inflated, rounded, and marked by axial ribs, which vary from sublamellar to one or more slender elements between them. These ribs are expanded at the summit and not at all expanded at the periphery in the early turns. The spiral sculpture is absent on the spire. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs. The wall of the broadly open umbilicus, in addition to the continuation of the ribs, is marked by 8 spiral threads, which render the stronger axial ribs nodulose. Last whorl solute for about one-tenth of a turn. Aperture almost circular; peristome simple. Operculum typically tudorid.

The type, U.S.N.M. No. 493482, comes from the Sierra del Cachimbo, east of the Sierra de Najaza, Camagüey Province. It has 4.2 whorls remaining and measures: Length, 9.7 mm.; greater diameter, 7.5 mm.; lesser diameter, 6.0 mm.

TUDORA (AGUAYOTUDORA) OBESA, new species**PLATE 27, FIGURE 9**

Shell elongate-ovate, rather stout, ranging in color from flesh color to pale chestnut-brown, with or without interrupted spiral bands of brown. Nuclear whorls 2, well rounded, microscopically granulose, forming a small apex. Postnuclear whorls marked by retractively curved axial riblets, which are rather irregular in strength and slightly so in spacing. They are about as wide as the spaces that separate them, and those of the early whorls are somewhat wavy or slightly nodulose. On the later turns this character is lost. The axial riblets become slightly exserted at the summit, particularly so on the early turns, where they also become somewhat thickened at the periphery. On the last whorl, however, these characters are lost. Suture strongly constricted. Periphery inflated, well rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs. Umbilicus narrow, open, bearing 9 slender spiral threads, which render the axial ribs nodulose. Last whorl solute for about one-tenth of a turn. Aperture oval, rendered crested by a carina at the posterior angle; peristome simple. Operculum typically tudorid.

The type, U.S.N.M. No. 493484, comes from the Sierra del Ca-chimbo, that is, between the Sierra de Chorrillo and the Sierra Najaza, Camagüey Province. It has lost the nuclear turns. The 4.2 whorls remaining measure: Length, 13.6 mm.; greater diameter, 8.2 mm.; lesser diameter, 6.7 mm.

WRIGHTUDORA, new subgenus

Shell small, elongate-ovate. Nuclear whorls inflated, well rounded, microscopically granulose. Postnuclear whorls with lamellar or sub-lamellar vertebrated axial ribs, which may or may not be gathered into tufts at the summit. Umbilicus open. Aperture subcircular; peristome double. Operculum typically tudorid. No breathing device is present.

Type: *Tudora (Wrightudora) enode* ([Gundlach] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS WRIGHTUDORA

Axial ribs gathered into tufts at the summit.....	enode
Axial ribs not gathered into tufts at the summit.	
Whorls strongly angulated in the middle.....	arcticoronata
Whorls not strongly angulated in the middle.	
Axial ribs uniform in strength and spacing.....	gundlachi
Axial ribs not uniform in strength and spacing.	
Axial ribs scalloped.....	semicoronata
Axial ribs not scalloped.....	garridoiana

TUDORA (WRIGHTUDORA) ENODE ([Gundlach] Pfeiffer)

PLATE 27, FIGURE 6

1860. *Ctenopoma enode* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 7, pp. 27-28.
1867. *Cyclostoma enode* ARANGO, Repert físico natural Isla de Cubana, p. 75.
1920. *Tudora (Tudorops) enode* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 77.

Shell elongate-conic, pale straw yellow. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by slightly retractively slanting axial riblets, which are produced at the summit, where 2 to 4 become fused to form a hollow denticle, particularly on the last whorl. On the earlier whorls this fusing is less strongly marked. Of the axial riblets 68 occur on the first of the remaining whorls, 144 on the second, and 154 on the last. The spiral sculpture consists of slender threads, which render the axial riblets wavy but scarcely nodulose. Of these spiral threads, 5 occur on the first, 6 on the second, and 8 on the last whorl, between summit and suture. Suture strongly constricted. Periphery well rounded. Base short, somewhat inflated, well rounded, marked by 3 spiral cords. The narrow open umbilicus and the somewhat descending and solute last whorl show the presence of 5 spiral threads on the umbilical wall. Aperture almost circular; peristome double, the inner moderately exerted and slightly reflected; the outer narrowly expanded, somewhat auriculated at the posterior angle, and marked by slender concentric laminae. Operculum typically tudorid.

The specimen described and figured, U.S.N.M. No. 356395, is a cotype collected by Gundlach and presented by Dr. de la Torre. It comes from Gibara, Oriente Province. It has 3.5 whorls and measures: Length, 7.7 mm.; greater diameter, 4.6 mm.; lesser diameter, 3.9 mm.

TUDORA (WRIGHTUDORA) ARCTICORONATA, new species

PLATE 27, FIGURE 4

Shell elongate-turreted, pale yellow. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a somewhat mammillated apex. Postnuclear whorls with an angulation on the middle of the turn marked by rather strong, lamellar axial ribs, between which finer axial riblets occur. The strong axial ribs are scalloped at intervals, and when these scallops are broken they reveal that they are hollow. The strong axial ribs are decidedly auriculated at the summit but they do not fuse to form cusps. Of the scallops 4 are present between the summit and the periphery, and the cusps at the summit indicate a fifth. Suture constricted, bridged by the cusps at the summit and by the scallops at the periphery. Base short, well

rounded, narrowly, openly umbilicated, marked by the continuation of the axial ribs, which here bear 3 scallops, the last being more acute and marking the outer limit of the umbilicus. The umbilical wall is also marked by the slender continuation of the axial riblets and by five slender spiral threads. The last whorl is solute for about one-tenth of a turn. Aperture subcircular; peristome double, the inner slightly exerted; the outer broadly expanded on the outer and basal lip, less so on the inner and parietal wall, very strongly fluted, the flutings forming denticulation on the inner lip. In addition to this the outer peristome is marked by slender, concentric laminae. Operculum typically tudorid.

The type, U.S.N.M. No. 493485, comes from Silla de Baez, west of Baracoa, Oriente Province. It has 5.1 whorls remaining and measures: Length, 8.6 mm.; greater diameter, 5.0 mm.; lesser diameter, 4.3 mm.

The elongate-turreted form, the strong angulations on the middle of the turns, and the strong differentiation of the axial riblets, which gives it a somewhat scalariform aspect, differentiate this from all the other *Wrightudoras*.

TUDORA (WRIGHTUDORA) GUNDLACHI, new species

PLATE 28, FIGURE 1

Shell small, elongate-conic, flesh colored, with a brownish flush. Nuclear whorls 2, inflated, well rounded, microscopically granulose, forming a small, almost mucronate, apex, the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, well rounded, marked by slender axial riblets, of which 62 occur on the first, 82 on the second, 144 on the third, and 172 on the last. These riblets are expanded into auricles at the summit and at the periphery, and where these two elements meet they sometimes fuse. The spiral sculpture consists of mere indications of threads too feebly expressed to be counted. Suture strongly constricted. Periphery weakly angulated. Base short, well rounded, marked by the continuation of the axial riblets and by a single spiral thread, which is a little nearer the umbilicus than the periphery. A strong spiral thread marks the junction of the base and the periphery, and its junction with the axial riblets renders these strongly scalloped. The umbilical wall is marked by the feeble continuation of the axial riblets and by 8 rather strong spiral threads. Last whorl solute for one-fifth of a turn. Aperture very broadly oval, almost subcircular; peristome double, the inner moderately, strongly exerted but not reflected; the outer narrowly expanded, strongly scalloped on the inner and basal lip, and marked by a series of concentric lamellae. Operculum typically tudorid.

The type, U.S.N.M. No. 493487, was collected by Gundlach at Mata, Oriente Province. It has 6.4 whorls remaining and measures: Length, 9.8 mm.; greater diameter, 5.2 mm.; lesser diameter, 4.5 mm.

This species most nearly resembles *Tudora* (*Wrightudora*) *garridoiana*, from which it can be readily distinguished by not having the axial riblets arranged in alternate series of strong and feeble assemblages.

TUDORA (WRIGHTUDORA) SEMICORONATA ([Gundlach] Pfeiffer)

PLATE 28, FIGURE 4

1861. *Cyclostoma semicoronatum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 7, pp. 28-29.

1865. *Ctenopoma semicoronatum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 117.

1920. *Ramsdenia semicoronata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 79.

Shell small, thin, elongate-conic, straw colored. Nuclear whorls 2, inflated, well rounded, microscopically granulose, forming a rather elevated tip. Postnuclear whorls inflated, strongly rounded, almost angulated in the middle, marked by retractively slanting, lamellar axial riblets, which are expanded into rather strong auricles at the summit and at the periphery; in adjacent whorls these two elements occasionally fuse. The axial riblets are hollow, and series of 2 to 4 strong riblets are separated by series of a similar number of weaker threads; of these riblets, 68 occur on the first, 112 on the second, and 118 on the last whorl. The spiral sculpture consists of moderately strong threads, which render the riblets wavy and scalloped at their junctions. Of these riblets, 4 occur on the first and 5 on the remaining turns between summit and suture. Suture strongly constricted. Base short, well rounded, openly moderately broadly umbilicated, marked by the continuation of the axial ribs and 3 spiral cords, of which the one marking the angle of the umbilicus is stronger than the rest. The umbilical wall is marked by the continuation of the axial riblets and by 6 slender spiral threads. Last whorl solute for about one-fifth of a turn. Aperture subcircular; peristome double, the outer broadly expanded, strongly scalloped at the edge, narrower on the parietal wall, produced into a moderately strong auricle at the posterior angle; inner peristome slightly exerted. Operculum as described for the species.

This species comes from Mata, Oriente Province. Gundlach says of it (Malakozool. Blätter, vol. 7, p. 29, 1861): "Animal brownish white. Dark dots form small spots and patches upon the snout and head. The region about the eye is rosy white; the interior of the head and antennae rose colored or rather bright coral red with fainter grayish apex. A dark coloration is present between the neck and foot."

The specimen described and figured, U.S.N.M. No. 356383, is one of two collected by Gundlach. It has 3.8 whorls and measures; Length, 7.3 mm.; greater diameter, 4.5 mm.; lesser diameter, 3.5 mm.

This race is most nearly related to typical *Tudora* (*Wrightudora*) *garridoiana garridoiana*, from which it differs by having the axial riblets much stronger and fewer in number.

TUDORA (WRIGHTUDORA) GARRIDOIANA ([Gundlach] Pfeffer)

Shell elongate-conic, pale straw colored. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by slightly retractively slanting, sublamellar, hollow riblets. These riblets are gathered into groups, several stronger lamellae being replaced by a number of weaker axial threads. These lamellae are developed into auricles at the summit and at the periphery. On adjacent whorls they frequently meet. The spiral sculpture consists of poorly developed threads, which are frequently merely indicated. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, marked by the continuation of the axial sculpture and by indications of obsolete spiral threads. A strong spiral cord marks the junction of the base with the umbilical wall. The umbilical wall is marked by the feeble continuation of the axial riblets and spiral threads. Last whorl solute for a fraction of a turn. Aperture subcircular; peristome double, the inner moderately exerted and slightly reflected; the outer moderately broadly expanded, somewhat wavy, developed into an almost clawlike element at the posterior angle, and marked by a series of slender concentric lamellae. Operculum typically tudorid.

This species comes from the region of Baracoa, Oriente Province, where it breaks up into two races as follows:

KEY TO THE SUBSPECIES OF TUDORA (WRIGHTUDORA) GARRIDOIANA

Inner lip of outer peristome rather wide.....	baracoensis
Inner lip of outer peristome not wide.....	garridoiana

TUDORA (WRIGHTUDORA) GARRIDOIANA BARACOENSIS, new subspecies

PLATE 28, FIGURE 5

This race comes from Baracoa. It can be distinguished from *T. (W.) garridoiana garridoiana* in being a little more slender and in having the outer peristome of the inner lip much more expanded and more strongly fluted.

The type, U.S.N.M. No. 356382, has 4.2 whorls remaining and measures: Length, 8.3 mm.; greater diameter, 5.2 mm.; lesser diameter, 3.8 mm.

TUDORA (WRIGHTUDORA) GARRIDOIANA GARRIDOIANA ([Gundlach] Pfeiffer)

PLATE 28, FIGURE 2

1860. *Cyclostoma garridoianum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 7, pp. 26-27.

The typical members of this subspecies come from El Yunque de Baracoa. It is distinguished from *T. (W.) garridoiana baracoensis* in having the outer peristome of the inner lip much less strongly expanded and less strongly fluted.

The specimen described and figured, U.S.N.M. No. 356381, has 4.5 whorls and measures: Length, 8.9 mm.; greater diameter, 5.4 mm.; lesser diameter, 4.3 mm.

TUDORINA, new subgenus

Shell very large, elongate-ovate, marked by both axial ribs and spiral threads on spire and base. Some of the axial ribs are gathered into tufts at the summit. Outer peristome narrowly expanded. Operculum typical of *Tudora*.

Type: *Tudora (Tudorina) rangelina* (Poey).

TUDORA (TUDORINA) RANGELINA (Poey)

PLATE 28, FIGURE 6

1851. *Cyclostoma rangelinum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, p. 98, pl. 8, figs. 13-19.

1890. *Colobostylus rangelinus* CROSSE, Journ. Conchyl., vol. 38, p. 303.

1920. *Tudora (Tudora) rangelina* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 77.

Shell rather large, broadly elongate-conic, varying from unicolor straw color to brownish, banded with spiral bands, or with interrupted spiral bands of brown of varying width and spacing; the interior of the aperture varies with the exterior; the peristome is soiled white, marked with brown, or unicolor. Nuclear whorls 2, well rounded, microscopically granulose, the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, marked by retractively slanting axial riblets and by spiral threads, the combination of the two forming a more or less fenestrated pattern. Both the axial riblets and the spiral threads become more numerous and more closely approximated on the last whorl than they are on the early turns; 2 to 6 or even more of these riblets become fused at the summit to form low whitish denticles, which are appressed to the preceding turn. Suture well constricted. Periphery well rounded. Base moderately long, well rounded, marked by axial riblets and by spiral threads like those on the spire. The base is openly, moderately broadly umbilicated, the umbilical wall being marked by the continuation of the axial riblets and by

spiral threads, which are a little broader and stronger than those on the rest of the base. Aperture broadly oval; peristome double, the inner but slightly exserted and appressed to the outer, but distinct all around; the outer narrowly expanded and slightly reflected, forming a conspicuous auricle at the posterior angle, which is adnate to the preceding turn. Operculum with the nucleus halfway between subcentral and submarginal, bearing a strong calcareous lamella, which is reflected to parallel the chondroid plate; the various turns of the calcareous lamella touch each other so as to form a continuous plate; the calcareous lamellae are marked by strong, retractively curved threads.

The specimen described and figured, U.S.N.M. No. 356362, is one of 5 topotypes from the Poey collection. It has 4.5 whorls remaining and measures: Length, 23.9 mm.; greater diameter, 15.8 mm.; lesser diameter, 12.7 mm.

This species is confined to the region of the Taco Taco River and Rangel, Pinar del Rio Province.

Genus ANNULARIA Schumacher

1817. *Annularia* SCHUMACHER, Essai d'un nouveau systeme des habitations des vers testaces, pp. 60, 196.

Shell ranging in form from depressed-helicoid to turbinate to elongate-conic. The sculpture may be almost obsolete or it may consist of axial riblets only, or of axial riblets and spiral threads; the latter may be confined to the umbilicus, or it may be present on the entire shell. There is a great range of variation in the strength of these sculptural features in different species. Breathing devices may be present or absent. The operculum consists of a chondroid plate, composed of a number of whorls, which bear a calcified spiral lamella on their inner edge; the lamella is obliquely deflected outward. The lamella on the succeeding turns does not fuse with that of its predecessor; there is always a space separating it from its neighbor. This lamella is always finely, obliquely striated, the striations varying considerably in strength in different species.

Type: *Turbo lincina* Linnaeus.

Typical *Annularia* has not been found in Cuba.

KEY TO THE CUBAN SUBGENERA OF THE GENUS ANNULARIA

Breathing siphon present.

Umbilicus open..... **Annularodes**

Umbilicus closed..... **Annularodisca**

Breathing siphon absent.

Breathing pore present.

Axial ribs articulated..... **Annularops**

Axial ribs not articulated.

Axial sculpture predominant..... **Annularodella**

Spiral sculpture predominant..... **Eutudora**

Breathing pore absent.

Breathing device reduced to a notch.

Axial sculpture predominant..... **Fossularia**

Spiral sculpture predominant..... **Eutudorisca**

Breathing device absent.

Lamella of operculum reenforced with strong, retractive-ly slanting riblets.....

Diplopoma

Lamella of operculum not reenforced with strong, retractive-ly slanting riblets.

Shell ranging from elongate-conic to elongate-ovate.

Spiral sculpture on spire present.

Axial sculpture articulated..... **Juannularia**

Axial sculpture not articulated.

Shell very large..... **Annularita**

Shell not large..... **Troschelvindex**

Spiral sculpture on spire absent.

Postnuclear whorls solute..... **Blaesospira**

Postnuclear whorls not solute.

Postnuclear whorls spinose..... **Guajaibona**

Postnuclear whorls not spinose. **Subannularia**

Shell not ranging from elongate-conic to elongate-ovate.

Shell depressed-helicoid..... **Annularisca**

Shell not depressed-helicoid.

Shell of turbinid shape.

Axial and spiral sculpture present on spire.....

Annularex

Peristome simple..... **Bermudezia**

Peristome double..... **Lugarenia**

Axial and spiral sculpture not present on spire.

Axial and spiral sculpture obsolete.....

Annularosa

Axial and spiral sculpture not obsolete.

Operculum with strong lamella.....

Annularella

Operculum with obsolete lamella.....

Chondropomatus

Subgenus ANNULARODES Henderson and Bartsch

1920. *Annularodes* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

Shell elongate-ovate, openly umbilicated, marked by regular, nonarticulate axial ribs and fine spiral threads on umbilical wall and adjacent base; breathing pore provided with an external siphon, which is directed backward, and which opens into the suture. Operculum typically annularid.

Type: *Annularia* (*Annularodes*) *uncinata* (Arango).

KEY TO THE SPECIES OF THE SUBGENUS ANNULARODES

- Last whorl decidedly solute.
 Outer peristome of inner lip broad..... *uncinata*
 Outer peristome of inner lip not broad..... *canoensis*
 Last whorl not decidedly solute.
 Last whorl free from the preceding turn, immediately behind
 the peristome.
 Outer lip of outer peristome moderately broad..... *terneroensis*
 Outer lip of outer peristome narrow.
 Axial ribs closely spaced..... *cantarillensis*
 Axial ribs not closely spaced..... *indivisa*
 Last whorl not free from the preceding turn, immediately be-
 hind the peristome.
 Sculpture fine and feeble..... *obsoleta*
 Sculpture not fine or feeble..... *perezi*

ANNULARIA (ANNULARODES) UNCINATA (Arango)

PLATE 28, FIGURE 7

1884. *Choanopoma uncinatum* ARANGO, Proc. Acad. Nat. Sci. Philadelphia, p. 211.

1920. *Annularia (Annularodes) uncinata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

Shell elongate-ovate, of straw-colored ground color, marked by rather large, interrupted, spiral bands of brown, which consist of rather large spots that are arranged in both axial and spiral series. Nuclear whorls decollated. Postnuclear whorls strongly rounded, marked by retractively curved axial riblets, of which 60 are present on the first and 112 are on the last whorl. These riblets become expanded at the summit into hollow tufts, or several of them may become fused to form such a tuft. Occasionally there is an indication of a slight nodule below the expanded summit. Suture strongly constricted. Periphery inflated, strongly rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs, which extend prominently into the umbilicus, and on the anterior portion of the umbilical wall by 12 spiral cords, which render the axial riblets nodulose. The last whorl is decidedly solute and deflected for about three-tenths of a turn. Aperture almost circular; peristome double, the inner moderately exerted and slightly reflected; the outer rather broadly expanded on the inner lip, a little less so on the parietal wall, and narrow on the outer and basal lip, forming a very conspicuous auricle, which embraces the reflected siphon. The outer peristome is marked by a series of concentric lamellae, which are particularly conspicuous at the auricle. Operculum typically annularid. The siphon is reflected backward and opens freely.

The specimen described and figured, U.S.N.M. No. 535616, a cotype, is from San Juan de los Yeras, Santa Clara Province. It was received from Arango by Dr. de la Torre. It has 4.0 whorls remaining and

measures: Length, 14.3 mm.; greater diameter, 7.4 mm.; lesser diameter, 6.8 mm.

This species agrees in the soluteness and deflection of its last whorl with *A. (A.) canoaensis*, from which it is easily distinguished by the broad inner lip of the outer peristome.

ANNULARIA (ANNULARODES) CANOAENSIS, new species

PLATE 28, FIGURE 8

Shell elongate-ovate, varying in color from straw color to pale brown, marked by rather pale, interrupted spiral bands of brown. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, well rounded, marked by slightly retractively curved axial ribs, of which 45 occur on the first and 110 on the last whorl. These riblets become expanded into feeble denticles at the summit or 2, 3, or 4 may become united to form a low hollow white cusp. Suture well constricted. Periphery of the last whorl well rounded. Base moderately long, well rounded, marked by the continuation of the axial ribs, which extend into the umbilicus, and on the umbilical wall by 13 feeble spiral threads, which render their junctions with the axial ribs feebly nodulose. The last whorl is solute for about one-sixth of a turn, decidedly deflected. Aperture subcircular; peristome double, the inner moderately exerted and slightly reflected; the outer rather narrow all around, forming a conspicuous auricle at the posterior angle, where it is reflected over and adjoins the siphon. The outer peristome is marked by concentric lamellae. Operculum typically annularid. The siphon is short, backward directed, and free.

The type, U.S.N.M. No. 535617, was collected by Dr. de la Torre at Casimbas de la Sierra de Canoa, Santa Clara Province. It has 4.4 whorls remaining and measures: Length, 14.0 mm.; greater diameter, 7.5 mm.; lesser diameter, 6.5 mm.

We have seen specimens also from Vereda del Alunado, Sierra de Jatibonico, which is nearby.

This species, like *A. (A.) uncinata*, has the last whorl solute and deflected, but is at once differentiated from that by its much narrower outer peristome of the inner lip.

ANNULARIA (ANNULARODES) TERNEROENSIS, new species

Shell elongate-conic, flesh colored, with broad interrupted spiral bands of brown, of which 4 occur between summit and suture and 4 are present on the base; the spiral bands show plainly in the interior of the aperture. Nuclear whorls 2, smooth, well rounded. Postnuclear whorls slightly inflated, well rounded, marked by rather distantly spaced, well-developed, retractively slanting axial riblets, which either singly or by the junction of two adjacent ones develop into slender hollow denticles at the summit. Suture strongly constricted.

Periphery well rounded. Base well rounded, narrowly umbilicated, marked by the continuation of the axial riblets, and within the narrow umbilicus by weak spiral threads. Last whorl solute for a tenth of a turn behind the peristome, which touches the preceding whorl. Aperture broadly ovate; peristome double, the inner slightly exerted; the outer broadly expanded on the inner lip and on the parietal wall, where it is somewhat fluted, narrowest on the outer lip, forming a conspicuous auricle at the posterior angle. Operculum typically annularid. Siphon behind the posterior angle of the aperture reflected backward into the suture.

This species appears restricted to the mountains of southern Santa Clara Province, where we are recognizing two subspecies:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULARODES) TERNEROENSIS

Umbilicus moderately broad.....	indioensis
Umbilicus narrow.....	terneroensis

ANNULARIA (ANNULARODES) TERNEROENSIS INDIOENSIS, new subspecies

PLATE 29, FIGURE 5

This subspecies was collected by Bermudez at El Indio, near San Juan de los Yeras, Santa Clara Province.

It differs from *A. (A.) terneroensis terneroensis* in being shorter, more ovate, with a broader umbilicus and by having the axial ribs of the last whorl more closely spaced.

The type, U.S.N.M. No. 535620, has 3.4 whorls remaining and measures: Length, 12.8 mm.; greater diameter, 7.7 mm.; lesser diameter, 6.7 mm.

ANNULARIA (ANNULARODES) TERNEROENSIS TERNEROENSIS, new subspecies

PLATE 29, FIGURE 2

This race was collected by Mr. Henderson at Loma del Ternero about 7 miles southeast of San Juan de los Yeras, Santa Clara Province. It differs from *A. (A.) terneroensis indioensis* in being more elongate, in having the ribs on the last whorl a little more distantly spaced, and in having a narrow umbilicus.

The type, U.S.N.M. No. 493403, has 4.2 whorls remaining and measures: Length, 15.4 mm.; greater diameter, 8.0 mm.; lesser diameter, 7.2 mm.

ANNULARIA (ANNULARODES) CANTARILLENIS, new species

PLATE 29, FIGURE 4

Shell elongate-ovate, straw colored, with faint, interrupted spiral bands of brown. Nuclear whorls 1.8, inflated, strongly rounded, microscopically granulose, forming a rather blunt apex. Postnuclear whorls inflated, strongly rounded, marked by slender, retractively

curved axial riblets, which are a little more distantly spaced on the early turns than on the last, where they are rather closely crowded; the spaces separating them on the last whorl are only a trifle wider than the riblets; these riblets may become expanded at the summit or 2, 3, or even more, may become fused to form small hollow cusps. Of these riblets, 54 are present on the first postnuclear whorl and 112 are present on the last whorl. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs, which extend into the open umbilicus, and by 12 spiral threads on the umbilical wall, which render the axial ribs nodulose at their intersection. The last whorl is solute for about one-tenth of a turn behind the peristome. Aperture almost circular; peristome double, the inner strongly exerted, particularly so on the outer lip, slightly slit at the posterior angle; the outer broadly expanded on the inner lip and the parietal wall, and adnate to the preceding turn at the parietal wall, narrow on the outer and basal lip, forming a moderately strong auricle at the posterior angle, which is marked by the concentric laminae. Operculum typically annularid. Siphon at the posterior angle of the aperture bent backward and opening there into the suture.

The type, U.S.N.M. No. 535622, was collected by Bermudez at Loma La Cantarilla, about 3 miles west of Guaracabulla, Santa Clara Province. It is a complete specimen having 5.8 whorls and measures. Length, 13.0 mm.; greater diameter, 7.6 mm.; lesser diameter, 6.0 mm.

ANNULARIA (ANNULARODES) INDIVISA (Welch)

PLATE 29, FIGURE 3

1929. *Choanopoma uncinatum indivisum* WELCH, Nautilus, vol. 42, p. 98, pl. 5, fig. 7.

1934. *Choanopoma (Annularodes) uncinatum indivisum* WELCH, Nautilus, vol. 47, p. 133, pl. 11, fig. 8.

Shell elongate-conic, pale wax color, or darker, with interrupted spiral bands of brown, of which 3 are present between summit and suture and 3 are on the base. The spiral bands show conspicuously on the inside of the outer lip. Nuclear whorls almost 2, inflated, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls slightly inflated, strongly rounded, and marked by rather distantly spaced, slender, retractively slanting axial riblets, which either individually or by fusion of two adjacent ribs form conspicuous hollow cusps at the summit. Of these ribs 50 are present on the first, 86 on the second, 122 on the third, and 126 on the last of the remaining turns. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, openly umbilicated, and marked by the continuation of the axial riblets and by fine spiral threads on the

umbilical wall. The last whorl is solute for about one-tenth of a turn behind the expanded peristome, which touches the preceding turn on the parietal wall, but which does not fuse with it. Aperture almost circular; peristome double, the inner fairly strongly exerted and very slightly reflected; the outer broadly expanded on the inner and parietal wall, narrow on the outer lip, forming a conspicuous auricle at the posterior angle, which is reflected backward. The outer peristome is marked by a series of concentric lamellae. Operculum typically annularid. Siphon immediately behind the peristome of the posterior angle of the aperture, reflected backward into the suture.

The specimen described and figured, U.S.N.M. No. 425685, is one received from Dr. Welch, who collected it at Loma Merino, Florencia, Camagüey Province, the type locality. It has 5.3 whorls remaining and measures: Length, 16.0 mm.; greater diameter, 7.5 mm.; lesser diameter, 6.7 mm.

We have specimens from various localities along the coast mountain range known as Sierra de Jatibonico, and the Sierra de Meneses.

This species most nearly resembles *A. (A.) terneroensis*, which, however, has the whorls shorter and more inflated, the shell more ovoid, and the color markings much stronger. The outer lip of the outer peristome is also broader.

ANNULARIA (ANNULARODES) OBSOLETA, new species

PLATE 29, FIGURE 6

Shell rather large, elongate-ovate, varying in color from straw color to pale brown. Unicolor, or marked with interrupted spiral bands of brown. Nuclear whorls almost 2, inflated, strongly rounded, microscopically granulose, forming a blunt apex. Postnuclear whorls increasing rather rapidly in size, inflated, strongly rounded, and marked by retractively curved axial ribs, of which 56 occur on the first and 127 are on the last whorl. These ribs are less wide than the spaces that separate them, and they are either singly or by a fusion of two expanded into hollow cusps at the summit. Suture well constricted. Periphery inflated, strongly rounded. Base inflated, strongly rounded, openly umbilicated, and marked by the continuation of the axial ribs, which extend into the umbilicus, the umbilical wall bearing many rather closely spaced, low, rounded spiral threads, which render the axial riblets slightly nodulose. The partial covering of the umbilicus by the reflected peristome makes it impossible to determine their actual number. Aperture circular; peristome double, the inner exerted and slightly reflected; the outer broadly expanded, mostly so on the inner lip, which quite obscures the umbilicus when viewed from the front, and on the parietal wall,

which it covers to quite an extent. The outer peristome is rendered rather irregular by the siphon at the posterior angle. Operculum typically annularid. The siphon is directed backward and opens into the suture.

The type, U.S.N.M. No. 535609, comes from the northeast slope of La Puntilla, near Remedios, Santa Clara Province. It is a complete specimen having 6.1 whorls and measures: Length, 18.8 mm.; greater diameter, 10.3 mm.; lesser diameter, 8.7 mm.

This species occurs abundantly at the type locality and in the region of Zulueta, Central San Agustín, and the north slope of the Sierra de Meneses, near Yaguajay and Juncalito; likewise at Pie Valdés and El Yigre, Yaguajay. Throughout this entire range the species maintains a remarkable concordance of characters, so that it is impossible to split it into subspecies. The large size will distinguish it at once from all the other *Annularodes*.

ANNULARIA (ANNULARODES) PEREZI, new species

Shell elongate-ovate, straw colored, with interrupted spiral bands of brown. The early nuclear whorls are also marked with brown. Nuclear whorls 2, small, inflated, microscopically granulose. Post-nuclear whorls well rounded, marked by strong, almost sublamellar, retractively curved axial ribs, which are a little more distantly spaced on the early turns than on the last. These ribs either individually, or by the combination of 2 or 3, form conspicuous hollow cusps at the summit. Suture strongly constricted. Periphery well rounded. Base moderately long, well rounded, openly umbilicated, marked by the continuation of the axial ribs, which extend over the umbilical wall, and by a series of spiral threads on the umbilical wall, which render the axial riblets nodulose. The actual number of these cannot be determined because of the reflected inner lip of the outer peristome. Aperture almost circular; peristome double, the inner exerted and slightly reflected; the outer broadly expanded on the inner and parietal wall, the latter adnate to the preceding turn, narrow on the basal and outer lip, forming a conspicuous auricle at the posterior angle, which is rendered irregular by the siphon. The outer peristome is marked by a series of concentric lamellae which are best developed at the auricle. Operculum typically annularid. Siphon reflected into the suture, where it opens. We are recognizing two subspecies, which the following key and descriptions will characterize:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULARODES) PEREZI

Interrupted spiral bands of brown conspicuous	perezi
Interrupted spiral bands of brown inconspicuous or absent	guitarti

ANNULARIA (ANNULARODES) PEREZI PEREZI, new subspecies

PLATE 29, FIGURE 7

Bartsch collected this subspecies on the north slope of the Sierra de Jatibonico.

It is distinguished from *A. (A.) perezii* in being larger and more elongate, with the whorls less rounded, and with the interrupted spiral bands well marked.

The type, U.S.N.M. No. 535612, comes from near Vereda de los Broqueles, Mayajigua. It has 4.0 whorls remaining and measures: Length, 16.4 mm.; greater diameter, 9.5 mm.; lesser diameter, 8.2 mm.

The animals of this species, collected by Bartsch August 9, 1928, are described by him as being pale yellow with a pinkish area about the tentacles. The tentacles are of the same color as the body, but they are tipped with gray at the expanded end. The animal when at rest suspends itself by a mucous thread.

ANNULARIA (ANNULARODES) PEREZI GUITARTI, new subspecies

PLATE 29, FIGURE 8

This race comes from Finca San Vicente, on the boundary of Santa Clara and Camagüey Provinces. It differs from the typical race in being smaller and in having the interrupted spiral bands scarcely indicated. The axial ribs are also much more elevated.

The type, U.S.N.M. No. 535614, has 4.0 whorls remaining and measures: Length, 14.7 mm.; greater diameter, 8.3 mm.; lesser diameter, 7.2 mm.

ANNULARODISCA, new subgenus

Shell elongate-ovate, with the umbilicus closed by the reflected posterior half of the outer peristome of the inner lip. The sculpture consists of nonarticulate axial ribs on the spire, to which are added spiral threads on the umbilical wall. Siphon connecting with the hollow axis by a slender channel behind the parietal outer lip, and through the axis with the exterior at the decollated apex.

This subgenus resembles *Annularodes*, but it differs materially from that subgenus in the arrangement of the siphon, which is like that of *Opisthocoele*.

Type: *Annularia (Annularodisca) pilsbryi* (Welch).

ANNULARIA (ANNULARODISCA) PILSBRYI (Welch)

PLATE 29, FIGURE 1

1929. *Choanopoma pilsbryi* WELCH, Nautilus, vol. 42, p. 98, pl. 5, fig. 1.

1934. *Choanopoma (Annularodes) pilsbryi* WELCH, Nautilus, vol. 47, p. 135, pl. 11, fig. 9.

Shell elongate-ovate, ranging from straw color to pale chestnut-brown, unicolor or interruptedly spirally banded. Nuclear whorls

decolated in all our specimens. Postnuclear whorls strongly rounded, marked by retractively curved, slender, rather distantly spaced axial riblets, which become expanded at the summit into narrow clawlike elements; in the dark colored specimens the axial riblets are strongly differentiated from the basic color by their white coloration. Suture strongly constricted. Periphery well rounded. Base moderately long, marked by the continuation of the axial riblets and by very strong spiral cords outside of the plugged umbilicus, which render the axial riblets here elongatedly nodulose. Aperture subcircular; peristome double, the inner well exerted and slightly reflected; the outer narrow on the anterior half of the outer lip and base, broadly expanded on the inner lip and parietal wall, forming a conspicuous auricle at the posterior angle. The inner lip of the outer peristome is inbent in the middle so as to completely cover the umbilicus. The outer peristome is marked by strong, concentric lamellae. Operculum typically annularid. The siphon is behind the peristome at the posterior angle of the aperture; it is bent into the suture and apparently communicates with the hollow axis, and through this with the truncated tip.

The specimen described and figured, U.S.N.M. No. 425683, is a cotype collected by Doctors Pilsbry and Welch on the hill east of the Chambas River near Florencia, Camagüey Province. It has 4.4 whorls remaining, and measures: Length, 15.4 mm.; greater diameter, 8.9 mm.; lesser diameter, 6.9 mm.

Subgenus ANNULAROPS Henderson and Bartsch

1920. *Annularops* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

Shell ranging in form from elongate-ovate to elongate-conic. Axial riblets sublamellar, rendered articulate by the spiral sculpture. Parietal wall perforated by a breathing pore near the posterior angle. Operculum typically annularid.

Type: *Annularia* (*Annularops*) *blaini* ([Gundlach] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS ANNULAROPS

Last whorl solute.

Shell broadly ovate..... *sauvallei*

Shell elongate-ovate..... *vannostrandii*

Last whorl not solute.

Outer peristome of inner lip notched, umbilicus closed.

Shell broadly ovate..... *semicana*

Shell elongate-ovate.

Shell pale..... *coronadoi*

Shell reddish..... *attenuata*

Outer peristome of inner lip not notched, umbilicus open.

Outer peristome of inner lip plicate..... *plicata*

Outer peristome of inner lip not plicate.

Outer peristome of inner lip slightly infolded.

Shell broadly ovate..... *blaini*

Shell elongate-ovate..... *tryoni*

Outer peristome of inner lip not infolded..... *perplexa*

ANNULARIA (ANNULAROPS) SAUVALLEI ((Gundlach) Pfeiffer)

Shell broadly ovate, flesh colored to pale orange. Nuclear whorls almost 2, smooth. Postnuclear whorls inflated, strongly rounded, marked by slender, sublamellar axial ribs, which are rendered wavy by the spiral threads, and which are rather closely spaced and are considerably more pronounced at the summit than on the rest of the turn. The spiral sculpture consists of low, rounded threads, which vary considerably in strength in the different races. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs and by spiral threads, which are considerably stronger here than are those on the spire. Base umbilicated; umbilicus partly covered by the reflected outer peristome of the inner and parietal lip. Last whorl decidedly solute. Aperture circular; peristome double, the inner moderately exerted and slightly reflected; the outer moderately broadly expanded, considerably wider on the posterior half of the inner lip than the rest. Operculum typically annularid.

This species is confined to Pinar del Rio Province, and it breaks up there into several races, which are defined in the following key and descriptions:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) SAUVALLEI

Shell white.

Axial ribs rather strong and coarse..... *cortinali*

Axial ribs not strong or coarse.

Axial ribs slender and fine..... *sauvallei*

Axial ribs exceedingly fine and slender..... *chorrerensis*

Shell pale orange..... *natensoni*

ANNULARIA (ANNULAROPS) SAUVALLEI CORTINALI, new subspecies

PLATE 30, FIGURE 6

This race comes from the south and the west sides of the Sierra de Güira. We have also seen it from the Abra de Caiguanabo. It is more slender than the others.

The type, U.S.N.M. No. 493450, has 82 ribs on the first whorl and 175 on the last turn. These riblets are stronger than in the other three white races, and they are also rendered somewhat sinuous by the spiral threads. The type has 3.9 whorls remaining and measures: Length, 10.6 mm.; greater diameter, 6.7 mm.; lesser diameter, 5.5 mm.

ANNULARIA (ANNULAROPS) SAUVALLEI SAUVALLEI ((Gundlach) Pfeiffer)

PLATE 30, FIGURE 7

1863. *Choanopoma sauvallei* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 10, p. 192.

1920. *Annularia (Annularops) sauvallei* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

This subspecies comes from the shore line of the Rio San Diego, from which we have specimens from the Portales de Galalon to Catalina.

The specimen figured, U.S.N.M. No. 11016, a topotype, has 3.5 whorls remaining and measures: Length, 11.2 mm.; greater diameter, 7.9 mm.; lesser diameter, 6.2 mm. It was collected by Wright at the foot of the Sierra La Güira; it has 102 riblets on the first turn, 170 on the second, and 238 on the last. These riblets, which are much stronger than those of *A. (A.) sauvallei chorrerensis*, are also rendered slightly sinuous by the spiral sculpture.

Gundlach states of the animal: "Gathered at the foot of the Sierra de Güira on large rocks in the forest. Animal bright gray with faint olive sheen. White dots are present on the rugosities of the foot and between the antennae and a black one upon the forehead. Tentacles coral red with blackish tip. The mass of the body where it emerges from the shell is of a dark olive coloration."

ANNULARIA (ANNULAROPS) SAUVALLEI CHORRERENSIS, new subspecies

PLATE 30, FIGURE 1

This subspecies was collected by Arango in the Sierra de la Chorrera. It differs from the other white members in having the axial ribs exceedingly fine, slender, and closely spaced. The spiral sculpture is quite obsolete, and it renders the axial riblets slightly wavy.

The type, U.S.N.M. No. 356158, has 108 riblets on the first of the remaining turns, 116 on the second, and 184 on the last. It has almost 4 whorls remaining and measures: Length, 9.7 mm.; greater diameter, 6.8 mm.; lesser diameter, 5.6 mm.

ANNULARIA (ANNULAROPS) SAUVALLEI NATENSONI, new subspecies

PLATE 30, FIGURE 3

This race was collected by Natenson at La Cantera, Consolación del Sur. It is easily distinguished from the others by the fact that the entire shell, as well as the peristome, is pale orange. The axial ribs and the spiral sculpture are stouter, also.

The type, U.S.N.M. No. 493454, has 4.2 whorls remaining and measures: Length, 13.2 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.2 mm.

ANNULARIA (ANNULAROPS) VANNOSTRANDI (Arango)

PLATE 30, FIGURE 5

1876. *Cyclostoma (Ctenopoma?) vannostrandi* ARANGO, An. Acad. Cienc. Med., Fis. Nat. Habana, vol. 12, p. 280.

Shell very elongate-ovate, almost turreted, white. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, and marked by very slender sublamellar axial riblets, of which 95 occur on the first and 181 are on the last turn. These riblets are only half the width of the spaces that separate them, and they are rendered wavy by the almost obsolete spiral threads. Suture very strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs and by the same feeble spiral sculpture. Within the umbilicus the axial riblets become stronger and the spiral threads are more pronounced. Aperture circular; peristome double, the inner slightly exerted; the outer broadly expanded, forming a slightly reflected auricle at the posterior angle, free on the parietal wall from the preceding turn. Operculum typically annularid.

The specimen figured, U.S.N.M. No. 493456, is Arango's type. It has 4 whorls remaining and measures: Length, 9.8 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.1 mm.

Arango stated that his unique specimen was collected on Wright's last excursion in the island of Cuba. He did not have a definite locality for it.

The collection of the United States National Museum contains four lots of specimens resembling the type, which come from mogotes near the Sierra de San Andres, namely, La Esperanza, La Cidra, and Bella Maria.

The solute last whorl is a character that is shared by *A. (A.) sauvalliei*, which is distinguished by its broadly ovate shell.

ANNULARIA (ANNULAROPS) SEMICANA (Morelet)

Shell rather large, broadly ovate, varying in color from flesh color to reddish. Nuclear whorls 2, well rounded, smooth, forming a rather pointed apex. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, sublamellar axial riblets, which are developed into auriclelike elements at the summit, where they are conspicuously retractively bent over at their free edge. The spiral threads are rather strong; their junctions with the axial ribs render these slightly wavy and feebly nodulose. Suture strongly constricted. Periphery inflated, strongly rounded. Base moderately long, inflated, strongly rounded, marked by the continuation of the axial ribs and by spiral threads, which are considerably stronger than those on the spire. The junctions of the spiral threads with the axial ribs render

them nodulose. Aperture circular; peristome double, the inner slightly exerted; the outer very broadly expanded on the inner lip and the parietal wall, less so on the outer and basal lip, deeply notched on the middle of the inner lip, and reflected posterior to this over the umbilicus as a strong callus. Operculum typically annularid.

This species ranges through the Organ Mountains and adjacent mogotes from Sumidero and Pan de Azucar east to the Sierra de Galalon.

The following key and brief diagnoses will help to differentiate the three subspecies here recognized:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) SEMICANA

Shell large, height more than 12 mm.

Shell flesh colored..... *semicana*

Shell reddish..... *organicola*

Shell small, height less than 11 mm..... *nana*

ANNULARIA (ANNULAROPS) SEMICANA SEMICANA (Morelet)

PLATE 30, FIGURE 10; PLATE 31

1851. *Cyclostoma semicanum* MORELET, Testacea novissima insulae Cubana et Americae Centralis, pt. 2, p. 20.

Morelet cites the southern part of the Isle of Pines as type locality for this species. All the intensive subsequent collecting in this island by de la Torre and Bartsch and others has failed to produce anything corresponding to Morelet's fine description. Dr. de la Torre examined Morelet's 3 cotypes in the British Museum, and he and Bartsch agree that the name should be applied to the present race. Thanks to the kind helpfulness of the authorities of the British Museum, it is possible to reproduce photographs of Morelet's specimens and thereby to dispel any doubt that might be entertained about the authors' contentions that *semicanum* belongs to the Organ Mountain fauna and not to that of the Isle of Pines. We are restricting the name *A. (A.) semicana semicana* to the race occupying the southern border of the Sierra Galalon.

It differs from the neighbor to the west, *A. (A.) semicana organicola* in being shorter, which gives it a more rotund appearance, and in being flesh colored instead of reddish.

The specimens figured on plate 31 are photographs of Morelet's cotypes in the British Museum, while figure 10, plate 30, shows one of a series collected by Natenson north of Ceja de Galalon, U.S.N.M. No. 493460. This specimen has 3.4 whorls remaining and measures: Length, 15.0 mm.; greater diameter, 11.8 mm.; lesser diameter, 9.2 mm. A smaller specimen from the same locality having 3.3 whorls measures: Length, 12.6 mm.; greater diameter, 9.9 mm.; lesser diameter, 7.9 mm.

ANNULARIA (ANNULAROPS) SEMICANA ORGANICOLA, new subspecies

PLATE 30, FIGURE 9

This subspecies appears to extend through the western Organ Mountains. We have seen it from Pan de Azucar; the old Isabel Maria (of Wright); Santo Tomás; the mogotes Dos Hermanos and those adjacent to these; Cuajani in the eastern end of the Sierra del Infierno; El Queque; Sierra de Viñales; Costanera del Abra; Hato Morales.

The shells of this subspecies are more elongated than those of *A. (A.) semicana semicana* and a reddish coloration prevails.

The type, U.S.N.M. No. 356258, comes from Mogotes Dos Hermanos near Viñales. It has 4 whorls remaining which measure: Length, 14.8 mm.; greater diameter, 11.6 mm.; lesser diameter, 8.6 mm.

ANNULARIA (ANNULAROPS) SEMICANA NANA, new subspecies

PLATE 30, FIGURE 2

This subspecies extends over the mogotes bordering the Pinar del Rio-Luis Lazo road between Sumidero, Cabezas, and Isabel Maria, thence through some of the mogotes bordering the east side of the Organ Mountains and possibly a few spots in the Sierra del Infierno, and mogotes bordering the road between Viñales and the Puerta del Ancón, thence some mogotes in Laguna de Piedras to Hoyo Largo de San Antonio off the Sierra de San Andrés. It appears to be a mogote form, not an occupant of the main sierras.

The small size readily distinguishes it from the other races.

The type, U.S.N.M. No. 385056, was collected by Bartsch near the stone quarry, on the first mogote on the north side of the road east of Cabezas. It has 3.4 whorls remaining and measures: Length, 10.4 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.8 mm.

ANNULARIA (ANNULAROPS) CORONADOI (Arango) Poey

Shell small, elongate-ovate, flesh colored or yellowish white. Nuclear whorls almost 2, well rounded, smooth. Postnuclear whorls inflated, strongly rounded, marked by crowded sublamellar axial ribs, which are rendered wavy by the low, rounded spiral threads. Suture strongly constricted. Periphery inflated, well rounded. Base inflated, well rounded, marked by the continuation of the axial ribs and by spiral threads, the latter a little stronger than those on the spire. Aperture circular; peristome double, the inner moderately exerted; the outer rather broadly expanded, notched on the middle of the inner lip with the part posterior to the notch reflected over the umbilicus, which it plugs, extending as a broad callus upon the parietal wall of the outer peristome; the rest is of about the same width and is

slightly fluted and marked by concentric lines of growth. Operculum typically annularid.

This species ranges over the central portion of Pinar del Rio, breaking up into several subspecies.

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) CORONADOI

Shell small, height less than 7 mm.....	coronadoi
Shell larger, height more than 10 mm.	
Axial riblets projecting strongly above the suture.....	acervata
Axial riblets not projecting strongly above the suture.....	spurca

ANNULARIA (ANNULAROPS) CORONADOI CORONADOI ([Arango] Poey)

PLATE 32, FIGURE 4

1867. *Cyclostoma coronadoi* [Arango] POEY, Repert fisico natural Isla de Cubana, vol. 2, p. 174.

Poey credits the manuscript for his description to Arango and states that Arango collected it at "Jaruco." This is undoubtedly Hoyo de Jaruco, a famous sink in the Sierra de la Chorrera. The race ranges from the Costanera de San Vicente and El Queque through the mogotes of Laguna de Piedras.

It is easily distinguished from the other two subspecies by its much smaller size.

The specimen figured, U.S.N.M. No. 356171, was collected by Wright at Viñales. It has a little more than 3 whorls remaining and measures: Length, 6.8 mm.; greater diameter, 5.1 mm.; lesser diameter, 3.8 mm.

ANNULARIA (ANNULAROPS) CORONADOI ACERVATA (Arango)

PLATE 32, FIGURE 3

1881. *Choanopoma acervatum* ARANGO, Proc. Acad. Nat. Sci. Philadelphia, p. 15.

This subspecies was described by Arango as coming from "Las Lagunitas," Pinar del Rio. It ranges from there north through Cayos de San Felipe and the mogotes at Kilometer 14, between Pinar del Rio and Viñales.

It almost reaches the size of *A. (A.) coronadoi spurca*, but differs from that in having the lamellose axial ribs developed into much more prominent projections, which here extend up on the preceding whorl.

The specimen figured, U.S.N.M. No. 483464, is a cotype from Arango. It has almost 4 whorls remaining and measures: Length, 9.8 mm.; greater diameter, 6.3 mm.; lesser diameter, 5.2 mm.

ANNULARIA (ANNULAROPS) CORONADOI SPURCA (Aguayo)

PLATE 32, FIGURE 1

1856. *Cyclostoma sordidum* (Gundlach) PFEIFFER, Malakozool. Blätter, vol. 3, p. 39. Not *Cyclostoma (Cyclotus) sordidum* Pfeiffer, Proc. Zool. Soc. London, 1855, p. 103.

1920. *Annularia (Annularops) sordidum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

1934. *Annularia spurca* AGUAYO, Mem. Soc. Cubana Hist. Nat. Felipe Poey, vol. 8, p. 89.

Cyclostoma sordidum (Gundlach) Pfeiffer was, unfortunately, preoccupied by Pfeiffer's earlier name, as set forth in the above synonymy. This was discovered by Aguayo, who substituted *Annularia spurca* for it. Gundlach says that his species comes from the mountains near San Diego de los Baños. We have it from the mogotes on both sides of the river north to La Catalina.

The shells of this subspecies are a little larger than those of *A. (A.) coronadoi acervata* and they have the axial ribs less strongly developed and less projecting above the suture at the summit. The specimen figured, U.S.N.M. No. 493465, is from the mogote at Cuatro Caminos. It has 3.9 whorls remaining and measures: Length, 11.0 mm.; greater diameter, 6.3 mm.; lesser diameter, 5.4 mm.

ANNULARIA (ANNULAROPS) ATTENUATA, new species

Shell very elongate-ovate, ranging from pinkish to rose-colored, the early whorls being always more intensely colored than the rest; the interior of the aperture and peristome varies from flesh color to pale red in the different subspecies. Nuclear whorls 2, small, well rounded, microscopically granulose. Postnuclear whorls well rounded, marked by sublamellar, retractively slanting, wavy axial riblets, which vary much in strength and spacing in the different races. The axial riblets are slightly exserted at the summit, where they project in varying degrees. The spiral sculpture, while pronounced, also varies much in strength in the different subspecies. The junctions of the spiral threads with the axial riblets render these slightly wavy and feebly nodulose. Suture strongly constricted. Periphery inflated, strongly rounded. Base moderately long, inflated, strongly rounded, marked by the continuation of the axial ribs and by the spiral threads, which are much stronger than those on the spire, and which render the riblets nodulose. Aperture circular; peristome double, the inner slightly exserted; the outer broadly expanded, decidedly more so, however, on the inner and parietal wall than on the rest, marked by a series of concentric lamina, and deeply notched on the middle of the inner lip. Posterior to the notch the peristome is reflected over the umbilicus, which it covers with a broad callus. Operculum typically annularid.

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) ATTENUATA

Interior of aperture and peristome reddish.....	minaensis
Interior of aperture and peristome white.	
Axial ribs coarse.....	morsei
Axial ribs fine.....	attenuata

ANNULARIA (ANNULAROPS) ATTENUATA MINAENSIS, new subspecies

PLATE 32, FIGURE 10

This subspecies appears restricted to Mogote La Mina, sometimes called Encinar Alto, northeast of Baños de San Vicente.

It is easily distinguished from the other two subspecies by the reddish peristome and interior of aperture.

The type, U.S.N.M. No. 356260, has 3.8 whorls remaining and measures: Length, 15.8 mm.; greater diameter, 10.0 mm.; lesser diameter, 8.2 mm.

ANNULARIA (ANNULAROPS) ATTENUATA MORSEI, new subspecies

PLATE 32, FIGURE 6

This subspecies was collected on Pan de Azucar during the *Tomas Barrera Expedition*. It is named for C. K. Morse, the engineer in charge of the Matahambre Mine, who was very helpful on that expedition.

In this, the westernmost known race, the axial ribs are strong and more distantly spaced than in the other races. The junctions of the axial ribs and spiral threads form somewhat pointed tubercles, which are retractively bent so that they almost overlap like tiles.

The type, U.S.N.M. No. 356239, has 4 whorls remaining and measures: Length, 13.7 mm.; greater diameter, 8.3 mm.; lesser diameter, 7.0 mm.

ANNULARIA (ANNULAROPS) ATTENUATA ATTENUATA, new subspecies

PLATE 32, FIGURE 5

This subspecies is known from the eastern end of the Sierra de San Andrés; Pico Grande, El Zumbido; Sitio de la Sierra and Mogotes de Talavera and Vegas Nuevas, near La Palma.

In coloration it resembles *A. (A.) attenuata morsei*, from which its very fine and closely spaced axial ribs will at once distinguish it.

The type, U.S.N.M. No. 493466, comes from Pico Grande; it is a complete specimen having 6.4 whorls and measuring: Length, 14.9 mm.; greater diameter, 8.4 mm.; lesser diameter, 6.7 mm.

ANNULARIA (ANNULAROPS) PLICATA, new species

PLATE 30, FIGURE 8

Shell elongate-ovate, flesh colored, with a pinkish tinge on the last whorl, turning consecutively deeper pink toward the first of the post-nuclear whorls. Nuclear whorls flesh colored; peristome flesh colored. Nuclear whorls 2, well rounded, microscopically granulose, forming a conspicuous apex. Postnuclear whorls inflated, strongly rounded, marked by almost vertical, strong, closely spaced axial riblets, of

which 72 occur on the first, 128 on the second, 180 on the third, and 248 on the last. The spiral sculpture is also rather strong. On the first turn, however, it is obsolete; 4 spiral threads are present on the second, 10 on the third, and 11 on the last between summit and suture. The junction of the spiral threads and axial ribs renders the latter wavy and slightly nodulose. Suture strongly constricted. Periphery inflated, well rounded. Base short, inflated, well rounded, marked by the continuation of the axial ribs and by 8 spiral threads, which grow consecutively stronger from the periphery to the umbilicus; within the umbilicus 9 additional weak spiral threads are present. Aperture circular; peristome double, the inner slightly exserted; the outer broadly expanded, considerably more so on the inner and the parietal wall, strongly plicate on the middle of the inner lip, and reflected as a broad flap over the umbilicus, which it does not completely cover. Operculum typically annularid.

The type, U.S.N.M. No. 356263, comes from Mogote de la Jagua, Pinar del Rio. It has 6.2 whorls and measures: Length, 15.4 mm.; greater diameter, 10.7 mm.; lesser diameter, 8.3 mm.

The peculiar folding—plication—of the inner lip of the outer peristome readily distinguishes this from the other species.

ANNULARIA (ANNULAROPS) BLAINI ((Gundlach) Pfeiffer)

Shell broadly ovate, varying greatly in size in the two races. The color shades from flesh color through yellowish to pale reddish, usually darkest on the early turns. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by closely spaced, somewhat wavy, sublamellar axial riblets, which vary considerably in strength in the two races; the axial riblets are more strongly developed at the summit, where they project as feeble auricles. The spiral sculpture is also variable in the two races; it is poorly expressed in *A. (A.) blaini cumbrensis*, while in *A. (A.) blaini blaini* it consists of low, rounded cords. Suture strongly constricted. Periphery inflated, well rounded. Base short, well rounded, marked by the continuation of the axial riblets and by spiral cords, the latter are also weaker in *A. (A.) blaini cumbrensis*. Aperture circular; peristome double, the inner slightly exserted; the outer broadly expanded on the inner lip and parietal wall, and less so on the outer and basal lip, somewhat infolded on the middle of the inner lip. Umbilicus partly hidden by the reflected peristome, but showing the spiral cords on the umbilical wall. Operculum typically annularid.

This species ranges through the mountains of La Güira and east to La Cumbre, near San Diego de los Banos, Pinar del Rio Province.

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) BLAINI

Spiral sculpture pronounced.....	blaini
Spiral sculpture obsolete.....	cumbrensis

ANNULARIA (ANNULAROPS) BLAINI BLAINI ([Gundlach] Pfeiffer)

PLATE 32, FIGURE 8

1863. *Choanopoma blaini* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 10, pp. 191-192.

1920. *Annularia (Annularops) blaini* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 74.

This subspecies inhabits the Sierra de La Güira and the mogotes adjacent to it. At first sight this shell may be confused with its neighbor, *A. (A.) semicana semicana*, with which it agrees in size. The open umbilicus, owing to the absence of the cut in the middle of the outer peristome of the inner lip and to the absence of its reflection over the umbilicus, will easily differentiate it from that shell. The specimen figured is one of a series, U.S.N.M. No. 356265, and has 3.8 whorls remaining which measure: Length, 17.2 mm.; greater diameter, 12.2 mm.; lesser diameter, 9.7 mm. Its large size will easily distinguish it from *A. (A.) blaini cumbrensis*.

Gundlach states of this subspecies (Malakozool. Blätter, vol. 10, p. 192, 1863): "After showers this mollusk can be found upon large stones in the crevices of which it withdraws in unfavorable seasons. Animal dark gray with whitish dots which group themselves into spots upon the foot and head. Head rose red within. Forehead with a dark suffusion. Tentacles coral red with blackish tip."

ANNULARIA (ANNULAROPS) BLAINI CUMBRENSIS, new subspecies

PLATE 32, FIGURE 2

This race, which was collected by Henderson on La Cumbre, is much smaller than typical *A. (A.) blaini blaini*. It also has the axial riblets much finer and more closely spaced and the spiral threads obsolete.

The type, U.S.N.M. No. 356161, has 3.5 whorls remaining and measures: Length, 10.7 mm.; greater diameter, 7.1 mm.; lesser diameter, 5.9 mm.

ANNULARIA (ANNULAROPS) TRYONI (Arango)

Shell elongate-ovate, pale yellow. Nuclear whorls 2, strongly rounded, smooth, microscopically granulose. Postnuclear whorls moderately inflated, strongly rounded, marked by rather strong, sublamellar, almost vertical axial riblets, of which 104 occur on the first, 140 on the second, and 164 on the last whorl in the type of *A. (A.) tryoni tryoni*, and 76 on the first, 104 on the second, and 184 on the last of the remaining whorls in *A. (A.) tryoni vinalensis*. The axial riblets are a little more strongly developed near the summit and the suture than on the middle of the turns. The spiral sculpture consists of poorly developed threads, of which 8 are present on the last whorl

between the summit and suture. Suture strongly constricted. Periphery strongly rounded. Base short, strongly rounded, marked by the continuation of the axial riblets and by 5 spiral threads in *A. (A.) tryoni tryoni* and 8 in *A. (A.) tryoni vinalensis*, which are a little stronger than those on the spire; within the umbilicus 4 additional spiral threads are apparent. Aperture circular; peristome double, the inner moderately exerted; the outer rather broadly, flaringly expanded, a little wider on the parietal wall than on the rest, slightly notched in the middle of the inner lip, but not reflected to cover the umbilicus posterior to the notch, and marked by concentric lines of growth. Umbilicus open. Operculum typically annularid.

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROPS) TRYONI

Spiral sculpture feeble.....	<i>tryoni</i>
Spiral sculpture not feeble.....	<i>vinalensis</i>

ANNULARIA (ANNULAROPS) TRYONI TRYONI (Arango)

PLATE 32, FIGURE 9

1879. *Ctenopoma tryoni* ARANGO, Contribucion a la fauna malacologica Cubana, p. 173.
 1898. *Choanopoma tryoni* KOBELT and MÖLLENDORFF, Nachr. Deutsch. Malak. Ges., vol. 30, p. 183.
 1920. *Annularia (Annularops) tryoni* HENDERSON and BARTSCH, Proc. U. S. Nat. Museum, vol. 58, p. 74.

The type of this species, U.S.N.M. No. 356163, which we have described and figured, was collected at Bebedero, Pinar del Rio. We have collected it abundantly on the Mogotes del Cerro de Cabras, at Kilometer 14, on the road between Pinar del Rio and Luis Lazo, which was the ancient watering place (called Bebedero).

It is distinguished from *A. (A.) tryoni vinalensis* by being a little more slender and by having the spiral sculpture only very feebly developed. The type has a little more than 3 whorls remaining and measures: Length, 7.5 mm.; greater diameter, 5.8 mm.; lesser diameter, 4.3 mm.

ANNULARIA (ANNULAROPS) TRYONI VINALENSIS, new subspecies

PLATE 32, FIGURE 7

We have seen this race from the Sierra de Viñales, mogotes de la Chorrera, and the type locality El Cuajani, the east end of the Sierra del Infierno.

It differs from typical *A. (A.) tryoni tryoni* in being a little less elongate-ovate, in having the spiral threads more strongly developed, and in rib count.

The type, U.S.N.M. No. 356160, has 3 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 6.0 mm.; lesser diameter, 4.7 mm.

ANNULARIA (ANNULAROPS) PERPLEXA, new species

PLATE 30, FIGURE 4

Shell small, broadly ovate, straw colored. Nuclear whorls decollated in all our specimens. Postnuclear whorls very strongly inflated and rounded, marked by retractively curved, sublamellar axial ribs, which are stronger near the summit, where there is a slight inclination toward the formation of tufts by the projection of some of these riblets a little above an interval of shorter ones. Of these axial ribs, 65 occur on the first, and 159 on the last of the remaining turns. These riblets are a little narrower than the spaces that separate them. The spiral sculpture consists of rather broad, low, feebly developed cords, of which 6 are present between the summit and the suture on the last turn. The junction of the axial ribs and spiral cords produces thickenings and slight projections which are directed backward. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs, which pass into the open umbilicus, and by 5 spiral cords of the same strength as those on the spire and which produce the same effect in their junction with the axial riblets. On the umbilical wall there are at least 6 additional spiral threads of about the same strength. Aperture circular; peristome double, the inner slightly exerted; the outer broadly expanded, tending toward the formation of a slight auricle at the posterior angle and a little wider on the posterior half of the inner lip, where it is almost flat without plication or infolding. Operculum typically annularid.

The type, U.S.N.M. No. 535682, comes from the Sierra del Abra. It has 3.2 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 5.6 mm.; lesser diameter, 4.7 mm.

This species is distinguished from the other *Annularops* by the flat inner lip of the outer peristome.

ANNULARODELLA, new subgenus

Shell elongate-ovate, openly umbilicated, marked by regular, non-articulate axial ribs on the spire, to which are added spiral threads on the umbilical wall. There is a puncture at the posterior angle of the aperture, which communicates directly with the exterior without a siphon.

Type: *Annularia* (*Annularodella*) *morenoi*, new species.

This group resembles the subgenus *Annularodes*, but lacks the siphon of that subgenus.

ANNULARIA (ANNULARODELLA) MORENOI, new species

PLATE 33, FIGURE 7

Shell very broadly ovate, almost turbate, of pale straw color, the ground color marked by interrupted spiral bands of brown. Peristome pale yellow, the outer rayed. The early nuclear whorls have the suture chestnut brown and a diffusion of this color extends to adjacent parts. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a somewhat blunt apex. Postnuclear whorls strongly inflated and strongly rounded, and marked by sublamellar, retractively curved, rather distantly spaced axial ribs, of which 24 occur on the first of the remaining turns, which is probably the first postnuclear turn, and 90 on the last whorl. These riblets become slightly expanded at the summit, where they form feeble denticles. Sometimes a second row of small nodules appears immediately below the summit. Suture strongly constricted. Periphery very strongly inflated, well rounded. Base short, inflated, strongly rounded, and widely openly umbilicated, marked by the continuation of the axial ribs and by about 16 spiral threads on the umbilical wall, which render the axial riblets slightly nodulose at their junction. Aperture subcircular; peristome double, the inner moderately exerted and strongly reflected, fusing on the outer lip with the outer; the outer peristome strongly expanded on the inner and parietal wall, adnate to the preceding turn at the parietal wall, a little less so on the basal wall and even less on the outer lip, marked by concentric laminae, and forming a moderately strong auricle at the posterior angle. There is a breathing puncture at the posterior angle of the aperture. Operculum typically annularid.

The type, U.S.N.M. No. 535633, comes from Ayongo, Las Jaguas, Sagua, Santa Clara Province. It has 4.1 whorls remaining and measures: Length, 10.5 mm.; greater diameter, 7.9 mm.; lesser diameter, 5.8 mm.

Subgenus EUTUDORA Henderson and Bartsch

1920. *Eutudora* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

Shell varying from broadly ovate to turbate in form. Spiral sculpture much stronger than the axial. A breathing pore is present in the parietal wall a little distance from the posterior angle of the aperture.

Operculum with the lamella reflected to parallel the chondroid basal plate, but not reaching to the outer edge of the whorls, thus leaving a narrow channel of the basal chondroid plate visible at the outer edge of the whorls.

Type: *Annularia* (*Eutudora*) *limbifera* ([Menke] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS EUTUDORA

Shell broadly turbinate.....	<i>cabrerai</i>
Shell turbinate.	
Surface of the shell wax glossy.....	<i>limbifera</i>
Surface of the shell not wax glossy.	
Peristome moderately expanded.....	<i>transitoria</i>
Peristome broadly expanded.....	<i>latistoma</i>

ANNULARIA (EUTUDORA) CABRERAI, new species

PLATE 33, FIGURE 1

Shell very broadly turbinate, almost helicoid, very widely openly umbilicated, flesh colored, with interrupted spiral bands of brown. The dots composing these bands are also arranged in axial series. Peristome white. Nuclear whorls 2, strongly rounded, microscopically granulose. The postnuclear whorls are marked by very strong spiral cords, of which 6 are present on the first and second whorls. On the last whorl there is an intercalated cord a little weaker than the heavier ones between each of the stronger, thus totaling 12 between the summit and the periphery. These cords are much narrower than the spaces that separate them. The axial sculpture consists of rather distantly spaced, feeble, threadlike riblets. Base short, strongly rounded, broadly openly umbilicated, marked by 7 spiral cords, which are of the same strength and spacing as those on the spire. The umbilical wall bears 13 additional spiral cords, which are rendered crenulated by the well marked, slender axial riblets. The last whorl is solute for about one-tenth of a turn. Aperture broadly oval; peristome double, the inner expanded and reflected and appressed to the outer; the outer is rather broadly expanded, a little wider on the anterior half of the columella, expanded into an auricle at the summit, and slightly fluted. A breathing pore is usually present on the parietal wall a little anterior to the posterior angle; sometimes this is absent. Operculum typically eutudorid.

The type, U.S.N.M. No. 356378, comes from Portugalete, near Cuatro Caminos, Habana Province. It has 5.5 whorls and measures: Length, 12.5 mm.; greater diameter, 12.5 mm.; lesser diameter, 9.0 mm.

ANNULARIA (EUTUDORA) LIMBIFERA ([Menke] Pfeiffer)

Shell almost trochid in shape, of flesh-colored, yellow, or pale brown ground color, marked by interrupted spiral series of brown spots; the peristome varies in color from white to soiled yellow; the interior of the aperture varies from flesh color to pale orange, usually showing the external color markings within. The entire surface has a dull waxy luster. Nuclear whorls 2, well rounded, microscopically granulose, except for the last portion of the last whorl, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly

inflated and strongly rounded. marked by poorly expressed incremental lines and spiral threads, which amount almost to narrow keels; the first and second spiral threads at the summit are slightly crenulated. Suture strongly constricted. Periphery well rounded. Base short, well rounded, openly umbilicated, marked by lines of growth and by spiral threads equaling those on the spire in strength. On the umbilical wall the axial lines of growth become somewhat intensified and the spiral threads become somewhat reduced. Aperture broadly oval; peristome double, the outer broadly, flaringly expanded and reflected; the inner narrow, exerted, and slightly reflected. A breathing pore is present on the parietal wall a little anterior to the posterior angle and within the edge of the aperture. Operculum typically eutudorid.

This species is confined to Matanzas Province, where it breaks up into two subspecies:

KEY TO THE SUBSPECIES OF ANNULARIA (EUTUDORA) LIMBIFERA

Umbilicus narrow.....	ternata
Umbilicus broad.....	limbifera

ANNULARIA (EUTUDORA) LIMBIFERA TERNATA (Reeve)

PLATE 33, FIGURE 5

1844. *Cyclostoma interruptum* GOULD, Proc. Boston Soc. Nat. Hist., vol. 4, p. 494.

Not *C. interruptum* Lamarck, 1822, Histoire naturelle des animaux sans vertèbres, vol. 6, pt. 2, p. 145.

1863. *Chondropoma ternatum* REEVE, Conchologia iconica, No. 65.

Reeve figured a specimen which he had received from Gould; Gould, in turn, received his material from Bartlett; and Bartlett collected near Matanzas. Reeve's figure shows the large race which we have in abundance from the region about the cave of Bellamar. We are therefore applying Reeve's name to the large race.

The specimen figured, U.S.N.M. No. 356399, comes from Bellamar and has 5.3 whorls and measures: Length, 16.2 mm.; greater diameter, 12.6 mm.; lesser diameter, 10.2 mm.

Under the name of *Cyclostoma interruptum* Sowerby, Gould says of the animal (Proc. Boston Soc. Nat. Hist., vol. 4, p. 494, 1844): "Animal light pea green, neck reddish, tentacles bright ferruginous, nearly carmine. When in rapid motion 'instead of proceeding directly ahead with the shell steady, it rests the shell on the ground until the body is extended as far as the shell will permit without dragging, and then by a sudden jerk, throws the shell forward, and so on alternately, much more rapidly than one would suppose possible. First one side of the animal moves, then the other, like an elephant.' "

ANNULARIA (EUTUDORA) LIMBIFERA LIMBIFERA ([Menke] Pfeiffer)

PLATE 33, FIGURE 6

1846. *Cyclostoma limbiferum* [Menke] PFEIFFER, Zeitschr. Malak., vol. 3, p. 45.
1847. *Chondropoma limbiferum* PFEIFFER, Zeitschr. Malak., vol. 4, p. 109.
1852. *Cistula limbifera* PFEIFFER, Conspectus cyclostomaceorum, p. 41.
1858. *Cistula catenata* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, p. 130, in part.
1920. *Eutudora (Eutudora) limbifera* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

Pfeiffer, in describing this species, cites as locality the Island of Cuba. He says the shells were communicated to him by Menke, and he gives as measurements: Length, 11 mm.; diameter, 7.5 mm. This marks as the typical race the smaller of the two subspecies. The name has usually been attached to the larger form.

This race ranges from La Cidra eastward to the upper reaches of the Canímar River past Limonar to the neighborhood of Matanzas. Its smaller size, little broader outline, and little wider umbilicus will differentiate it from *A. (E.) limbifera ternata* Reeve.

The specimen figured, U.S.N.M. No. 356576, comes from Limonar. It has 5.2 whorls and measures: Length, 12.0 mm.; greater diameter, 9.5 mm.; lesser diameter, 7.1 mm.

The animals of this subspecies, collected by Bartsch July 24, 1928, on the paredones of the Rio Canímar below the central highway, were described as follows: Animal short, smoke colored above; sides of the body somewhat paler toward the edge of the foot; sole of the foot the same color as this edge. Tentacles and eye ring flesh-colored, the rest pale orange with buff suffusion, dark red at the tip. The animal when in motion moves the shell along with a sidewise jerk, which gives it the appearance of progressing by a series of jumps. This species appears to range eastward through Cardenas to Sagua La Grande, Santa Clara Province.

ANNULARIA (EUTUDORA) TRANSITORIA, new species

Shell trochoid, flesh colored, with interrupted spiral bands of brown, which are rather closely spaced; these are present on spire and base. The elements composing these bands are arranged in both axial and spiral series. The peristome is white; the interior of the aperture is almost white. Nuclear whorls 2, well rounded, microscopically granulose, except the last portion of the last whorl, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by very strong lamellar spiral cords; the first of these is rendered slightly crenulated by indications of axial riblets near the summit. Suture strongly channeled. Pe-

riphery inflated, strongly rounded. Base inflated, strongly rounded, openly umbilicated, marked by spiral cords, which are as strong as those on the spire; the umbilical wall and the anterior portion of the base are marked by slender, closely spaced, axial riblets; the umbilical wall, in addition to this, bears slender spiral threads, which render these riblets slightly nodulose. Aperture broadly oval; peristome double, the outer moderately broadly expanded, the inner inconspicuously reflected over and appressed to the outer, separated at the posterior angle. The breathing pore on the parietal wall is a little anterior to the posterior angle and within the edge of the aperture. Operculum typically eutudorid.

We are recognizing two subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (EUTUDORA) TRANSITORIA

Shell of trochid outline.....	transitoria
Shell of very broadly trochid outline.....	distincta

ANNULARIA (EUTUDORA) TRANSITORIA TRANSITORIA, new subspecies

PLATE 33, FIGURE 4

1878. *Cistula limbifera* ARANGO, Contribucion a la fauna malacologica Cubana, pp. 22-23, in part.

This subspecies has the shell much more narrowly turbinate than *A. (E.) transitoria distincta*. In the type 6 of the strong spiral cords are present between the summit and suture on the first postnuclear turn, 7 on the second, and 14 on the last. The umbilical wall bears 15 slender spiral threads.

The type, U.S.N.M. No. 386051, was collected by Bartsch on the Sierra del Grillo, Habana Province. It has 6.0 whorls and measures: Length, 13.3 mm.; greater diameter, 10.2 mm.; lesser diameter, 8.0 mm.

This subspecies ranges from Sabana de Robles east, through the Sierra del Grillo, Madruga to El Mogote, Ceiba Mocha, and to Cabezas; in other words, it occupies those interior hills on the east end of Habana Province, extending across the line into Matanzas Province.

The animals of this species were collected by Bartsch in a stone fence of the Finca El Ingles, near the Sierra del Grillo on July 15, 1928. He described them as follows: Flesh-colored with smoky suffusion, darker on the sides. Head gray, modified by an endless number of white dots. Snout a little paler than the dorsum. Tentacles sooty, tipped with pale orange. Foot deeply, medially cleft, smoky gray. Motion of the sides alternate. When in motion the animal moves the shell along sidewise with a jerk. The shell is thus carried forward in a series of jumps.

ANNULARIA (EUTUDORA) TRANSITORIA DISTINCTA, new subspecies

PLATE 33, FIGURE 2

This subspecies was collected by Dr. de la Torre at El Volcan on the road between Habana and Managua. It is readily distinguished from *A. (E.) transitoria transitoria* by its much more broadly trochid outline. It also has the inner lip of the outer peristome not so broadly expanded.

The type, U. S. N. M. No. 493469, has 5.3 whorls and measures: Length, 12.0 mm.; greater diameter, 10.4 mm.; lesser diameter, 7.3 mm.

ANNULARIA (EUTUDORA) LATISTOMA, new species

PLATE 33, FIGURE 3

Shell of turbate outline, orange in ground color, marked by interrupted spiral bands of brown. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, marked by slender, lamellar spiral threads, of which the two near the summit are minutely denticulated. The spaces separating the spiral threads are wider than the threads. The axial sculpture consists of scarcely perceptible lines of growth and occasional resting stages, which appear as retractorily slanting pale lines. Suture channeled. Periphery inflated, well rounded. Base short, inflated, strongly rounded, broadly, openly umbilicated, marked by the same sculpture as that characterizing the spire, except that the axial sculpture here becomes intensified and assumes the nature of fine, closely spaced threads, which are particularly conspicuous in the spaces between the spiral threads. The umbilical wall is likewise marked by spiral threads and by the continuation of the axial sculpture, which here renders the spiral sculpture minutely denticulated. Aperture broadly ovate; peristome double, the inner slightly exserted, reflected over and appressed to the outer; the outer expanded and slightly reflected. Breathing pore on the parietal wall a little anterior to the posterior angle of the aperture, and a little within the edge of the peristome. Operculum typically tudorid.

This species occupies the southern part of the island, on both sides of the boundary between Pinar del Rio and Habana Provinces. While it resembles *A. (E.) limbifera* in general shape, it can at once be distinguished from that by lacking the dull wax coloration and by having stronger spiral sculpture.

FOSSULARIA, new subgenus

Shell elongate-ovate, marked by axial ribs, which are slightly, regularly wavy, suggesting spiral sculpture; base and umbilical wall

are marked by feeble spiral cords. Aperture very broadly ovate; peristome double, with a slight notch at the posterior angle. Operculum with reflected lamella, which does not reach to the outer margin of the chondroid basal whorls.

Type: *Annularia (Fossularia) boqueronensis*, new species.

KEY TO THE SPECIES OF THE SUBGENUS FOSSULARIA

Axial ribs fine and closely spaced.....	<i>inquisita</i>
Axial ribs not fine or distantly spaced.....	<i>boqueronensis</i>

ANNULARIA (FOSSULARIA) INQUISITA (Pilsbry)

PLATE 34, FIGURE 5

1929. *Choanopoma inquisita* PILSBRY, Nautilus, vol. 42, p. 80, pl. 5, fig. 2.

Shell elongate-conic, flesh colored, with interrupted spiral bands of brown, 4 of which are between the summit and suture, and 4 are on the base; peristome corresponding to the ground color. Nuclear whorls decollated in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by retractively curved, well elevated axial riblets, which are a little narrower than the spaces that separate them. Of these, 178 are present on the last whorl. These riblets become a little paler and slightly intensified on the summit and therefore are more differentiated here than on the rest of the turn. Suture well constricted. Periphery inflated, strongly rounded. Base rather short, inflated, strongly rounded, marked by the continuation of the axial ribs, and near the umbilical wall marked by several obsolete threads. The umbilicus is moderately broad and its wall is marked by hairline continuations of the axial ribs and apparently by no spiral sculpture. The last whorl is solute for about one-tenth of a turn. Aperture broadly oval; peristome double, the inner slightly exerted, reflected and appressed to the outer, which is narrowly expanded, and which develops into a channel at the posterior angle. Operculum typically fossularid.

The specimen described and figured, U.S.N.M. No. 426045, a paratype received from Dr. H. A. Pilsbry, comes from Florencia, Camagüey Province. It has 4.3 whorls remaining and measures: Length, 14.7 mm.; greater diameter, 10.3 mm.; lesser diameter, 7.8 mm.

ANNULARIA (FOSSULARIA) BOQUERONENSIS, new species

PLATE 34, FIGURE 6

Shell elongate-conic, pale yellow, with the faintest indication of 6 interrupted spiral bands of brown between summit and suture; similar, much fainter bands are indicated on the base. Nuclear whorls

decollated in all our specimens. Postnuclear whorls rather high between summit and suture, marked by decidedly retractively slanting, slender, sublamellar axial riblets, of which 115 are present on the last turn. These riblets are only about one-fourth as wide as the spaces that separate them. They become slightly intensified and a trifle expanded at the summit. Suture well constricted. Periphery well rounded. Base moderately long, well rounded, openly umbilicated. The umbilical wall is marked by the continuation of the axial riblets and by weakly developed spiral threads, which extend up on the anterior half of the base. Last whorl solute for about one-eighth of a turn. Aperture broadly oval; peristome double, the inner decidedly exserted and slightly reflected, forming a slender notch at the posterior angle, where it is backward deflected, suggesting a siphon. The outer peristome is rather broadly expanded and reflected and it is likewise bent backward at the posterior angle. Operculum typically fossularid.

The type, U.S.N.M. No. 493488, comes from Boquerón del Jaticónico, Santa Clara Province. It has almost 5 whorls remaining and measures: Length, 18.7 mm.; greater diameter, 10.3 mm.; lesser diameter, 8.3 mm.

Subgenus *EUTUDORISCA* Henderson and Bartsch

1920. *Eutudorisca* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

1920. *Eutudorella* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

Shell almost turbinate in form, spiral cords much stronger than the axial sculpture, which is decidedly reduced, almost obsolete. A notch in the parietal callus near its junction with the outer lip leaves a breathing space here, when the animal is withdrawn. Operculum with the lamella reflected outward to parallel the chondroid basal plate, but falling short of reaching the outer edge of the whorls, thus leaving a zone of the chondroid plate showing in each turn.

Type: *Annularia* (*Eutudorisca*) *jimenoi* ([Arango] Pfeiffer).

We now believe that there is not sufficient distinction between *Eutudorisca* and *Eutudorella* for subgeneric designation, and we therefore merge the second name under the first.

KEY TO THE SPECIES OF THE SUBGENUS *EUTUDORISCA*

Peristome broadly expanded.....	<i>jimenoi</i>
Peristome not broadly expanded.	
Notch at the posterior angle of aperture scarcely perceptible..	<i>camoensis</i>
Notch at the posterior angle of aperture well developed.	
Shell broadly conic.....	<i>agassizi</i>
Shell broadly ovate.....	<i>catenata</i>

ANNULARIA (EUTUDORISCA) JIMENOI ([Arango] Pfeiffer)

PLATE 34, FIGURE 1

1864. *Cistula jimenoï* [Arango] PFEIFFER, Malakozool. Blätter, vol. 11, p. 160.

1867. *Cyclostoma jimenoï* ARANGO, Repert físico natural Isla de Cubana, p. 75.

1920. *Eutudora* (*Eutudorisca*) *jimenoï* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

Shell broadly conic, almost turbinate, flesh colored with interrupted spiral bands of brown. Nuclear whorls almost 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly inflated, strongly rounded, marked by feeble incremental lines and by strong spiral threads, of which 8 occur on the first whorl, 9 on the second, 14 on the third, and 15 on the last between the summit and suture; the addition of the spiral threads always begins in an inconspicuous manner, and as the shell increases the threads increase in size. The spiral thread at the summit is feebly crenulated, and some of the others show mere indications of minute nodules. Suture strongly constricted. Periphery inflated, strongly rounded. Base inflated, strongly rounded, narrowly, openly umbilicated, marked by 11 spiral threads and by incremental lines; the latter render the summit of the spiral threads feebly nodulose. The umbilical wall is marked by the continuation of the axial riblets and by 18 spiral threads, the junction of the two rendering the spiral threads serrated. Aperture broadly oval; peristome simple, broadly expanded, notched on the parietal wall near the posterior angle to fit the preceding turn, to which it is adnate, and to leave a breathing space when the operculum is withdrawn. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 356369, is a cotype collected by Arango at the ancient Ingenio San Luis, Jaruco, Habana Province. It has 5.7 whorls and measures: Length, 16.9 mm.; greater diameter, 14.6 mm.; lesser diameter, 9.9 mm.

This species seems to range through the surrounding hills extending from a little west of Tapaste to Jaruco.

The animal of this species was collected by Bartsch on July 28, 1928. He describes it as follows: Animal short, upper surface darker than the rest, marked by numerous white dots. A ring about the base of the tentacles is almost white. There is a short pinkish streak immediately behind this; sides of body smoke gray with a bluish tinge, a little paler than the dorsum. Tentacles white at base, the rest orange tipped with brownish buff. Sole of the foot same color as the sides. The animal when at rest suspends itself by a mucous thread.

ANNULARIA (EUTUDORISCA) CAMOENSIS, new species

PLATE 34, FIGURE 2

Shell very broadly conic, pale orange, with a little paler tip and with interrupted spiral bands of brown; the peristome is pale yellow, while the interior of the aperture is orange. Nuclear whorls almost 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly inflated, strongly rounded, marked by incremental lines and by 8 spiral threads on the first and second turns, 13 on the third, and 20 on the last. The first two spirals near the summit are rendered finely serrated by the axial threads. The spiral threads vary in strength, the intercalated ones being always weaker than the stronger ones, between which they occur. Suture strongly impressed. Periphery strongly rounded. Base rather short, inflated, strongly rounded, marked by 21 spiral threads of varying strength, those near the umbilicus being finely denticulated. The umbilical wall is marked by rather rough incremental lines, which assume almost the strength of axial riblets, and by 20 spiral threads. Last whorl solute for about one-fifth of a turn. Aperture broadly ovate; peristome simple, moderately broad, flaringly reflected, narrower on the posterior half than the anterior. Operculum typically annularid.

The type, U.S.N.M. No. 356370, was collected by Mr. Henderson at Loma de Camoa, Habana Province. It has 5.6 whorls and measures: Length, 15.2 mm.; greater diameter, 11.8 mm.; lesser diameter, 9.3 mm.

ANNULARIA (EUTUDORISCA) AGASSIZI ([Charpentier] Pfeiffer)

PLATE 34, FIGURE 4

1852. *Cistula agassizii* [Charpentier] PFEIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 183.
1853. *Cyclostoma agassizii* PFEIFFER, Martini-Chemnitz Conchylien Cabinet, vol. 1, sect. 19, pp. 280-281, pl. 38, figs. 1, 2.
1863. *Chondropoma agassizii* REEVE, Conchologia iconica, No. 64.
1920. *Eutudora (Eutudorella) agassizii* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

Shell almost turbinate, yellow, with the peristome and the interior a little paler, and with the spire and base marked by interrupted spiral bands of brown, which are narrow and distantly spaced. Nuclear whorls almost 2, well rounded, microscopically granulose, except the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by sublamellar spiral threads, of which 8 occur on the first and second turns, and 15 on the last between summit and suture. The spiral threads near the summit show indications of fine serrations due to their being crossed by lines of growth. Suture narrowly channeled,

strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by 7 spiral threads, which equal those on the spire in strength. The anterior half of the base is marked by slender axial riblets, which extend into the umbilicus, and which at their crossing with the spiral threads render these slightly crenulose; within the umbilicus 12 spiral threads are present, which likewise render the axial riblets crenulated. Last whorl solute for about one-fifth of a turn. Aperture broadly ovate; peristome simple, moderately expanded, slightly scalloped on the inner lip and deeply, obliquely notched on the parietal wall near the posterior angle to form a breathing space. Operculum typically annularid.

The type, U.S.N.M. No. 356373, was collected by Mr. Henderson at Loma de Candela, Habana Province. It has 5.1 whorls and measures: Length, 10.2 mm.; greater diameter, 9.2 mm.; lesser diameter, 7.0 mm.

ANNULARIA (EUTUDORISCA) CATENATA (Gould)

Shell broadly ovate, flesh colored with a buffish tinge; the spiral keels are marked with interrupted spots of brown. The interior of the aperture is the same as the exterior. Nuclear whorls 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by sublamellar spiral cords, of which 7 occur on the first, 10 on the second, and 14 on the last. The axial sculpture consists of incremental lines, which render the first 2 or 3 spiral threads next the summit slightly nodulose. Suture strongly constricted. Periphery inflated, strongly rounded. Base short, inflated, strongly rounded, marked by 6 spiral threads, which are a trifle stronger than those on the spire; on the umbilical wall the axial sculpture assumes the strength of slender riblets, and the spiral threads are reduced in size and spacing, 19 of them being present in the typical race and 11 in *A. (E.) catenata blanesi*. The junction of the axial riblets with the spiral threads forms slender nodules. The last whorl is solute for one-fifth of a turn. Aperture broadly oval; peristome simple, only slightly expanded. Operculum typically annularid.

This species is rather widely distributed in Matanzas Province, ranging from Limonar to Coliseo to Cardenas.

We are recognizing two subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (EUTUDORISCA) CATENATA

Spiral threads on umbilical wall many, closely spaced.....	<i>catenata</i>
Spiral threads on umbilical wall few, distantly spaced.....	<i>blanesi</i>

ANNULARIA (EUTUDORISCA) CATENATA CATENATA (Gould)

PLATE 34, FIGURE 7

1843. *Cyclostoma catenatum* GOULD, Proc. Boston Soc. Nat. Hist., vol. 1, p. 138.
1847. *Chondropoma catenatum* PFEIFFER, Zeitschr. Malak., vol. 4, p. 109.
1852. *Cistula catenatum* PFEIFFER, Catalogue of Phaneropneumona . . . in the British Museum, pp. 182-183.
1920. *Tudora (Eutudorisca) catenata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 78.

This race extends from Limonar through Coliseo. It is larger than *A. (E.) catenata blanesi*, and it has many more spiral threads on the umbilical wall, 19 being present in the specimen figured, while *A. (E.) catenata blanesi* shows only 11.

The specimen figured, U.S.N.M. No. 493490, was collected by Bartsch on a limestone bluff near the rifle range at Limonar. It has 5.5 whorls and measures: Length, 12.5 mm.; greater diameter, 8.7 mm.; lesser diameter, 7.0 mm.

The animal of this species, collected at the rifle range 2 miles south of Limonar July 23, 1928, is described by Bartsch as having a short body, the entire animal being buff except for a dark band across the head immediately in front of the tentacles, behind which there is a pinkish flush. Tentacles orange, except for a dark short streak on the dorsal side near the base; the extreme tip, which is slightly stouter than the part preceding, is brownish. Sole of the foot deeply medially cleft, of the same color as the body. The motion of the foot is alternate on the two sides. The animal when at rest suspends itself by a mucous thread.

ANNULARIA (EUTUDORISCA) CATENATA BLANESI, new subspecies

PLATE 34, FIGURE 3

This is a small race from Cardenas. It also has much fewer spiral threads on the umbilical wall.

The type, U.S.N.M. No. 493491, has 5.1 whorls and measures: Length, 10.4 mm.; greater diameter, 7.8 mm.; lesser diameter, 6.8 mm.

Subgenus DIPLOPOMA Pfeiffer

1859. *Diplopoma* PFEIFFER, Malakozool. Blätter, vol. 6, p. 73.

Shell varying from elongate-ovate to elongate-conic. Postnuclear whorls marked by sublamellar axial riblets and spiral threads. Operculum with a broad calcified lamella, which bends obliquely outward to almost parallel the basal plate on its outer half. This lamella is reinforced by numerous strong, obliquely retractorily curved, slender lamellae.

Type: *Annularia (Diplopoma) architectonica* ([Gundlach] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS DIPLOPOMA

Axial ribs fused in groups to form broad hollow tufts at the summit.

Outer peristome broad.

Peristome adnate..... *torrei*

Peristome solute..... *ramsdeni*

Outer peristome narrow..... *architectonica*

Axial ribs not fused in groups to form broad hollow tufts at the summit.

Axial sculpture well developed.

Spiral sculpture obsolete on spire..... *pilsbryi*

Spiral sculpture not obsolete on spire..... *songoensis*

Axial sculpture obsolete..... *obsoleta*

ANNULARIA (DIPLOPOMA) TORREI (Ramsden)

PLATE 35, FIGURE 1

1915. *Diplopoma torrei* RAMSDEN, Nautilus, vol. 28, pp. 34-35.

1920. *Diplopoma torrei* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 80.

Shell elongate-conic, flesh colored, straw colored, or pale brown, marked by interrupted spiral bands of brown. Nuclear whorls 2, well rounded, microscopically granulose, the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, marked by almost vertical or slightly retractively curved axial riblets, which are frequently hollow. These riblets are gathered into tufts at the summit, 2 to 8 forming a tuft, the tufts being rather irregular in width and spacing; of these axial ribs, 48 occur on the first, 58 on the second, 82 on the third, 124 on the fourth, and 204 on the last in the specimen described and figured. The spiral sculpture consists of rather strong threads, which render the axial riblets slightly nodulose at their junction. Of these threads, 5 occur on the second, 6 on the third, and 9 on the remaining turns between summit and suture. Suture moderately constricted. Periphery well rounded. Base short, well rounded, narrowly, openly umbilicated, marked by the continuation of the axial ribs and by 5 strong spiral threads, which render the axial ribs conspicuously nodulose. The axial ribs extend feebly upon the umbilical wall where 11 additional spiral threads are visible, which also render the axial ribs nodulose at their junction. The last whorl has the outer peristome adnate to the preceding turn. Aperture broadly oval; peristome double, the inner slightly exerted; the outer broadly expanded, fluted, forming a conspicuous auricle at the posterior angle and marked by concentric laminae. Operculum typically diplopomid.

The specimen described and figured, U.S.N.M. No. 356501, is a cotype received from Dr. Torre and it was collected by Dr. Ramsden at Ojo de Agua, near Filipinas, Guantánamo, Oriente Province. It

has a little over 5 whorls and measures: Length, 13.7 mm.; greater diameter, 7.7 mm.; lesser diameter, 5.6 mm.

This species is easily distinguished from the rest by its broadly expanded peristome and by having the parietal wall of the peristome adnate to the preceding turn instead of being solute.

ANNULARIA (DIPLOPOMA) RAMSDENI, new species

PLATE 35, FIGURE 7

Shell very large, elongate-conic, chestnut-brown, with the summit of the turns soiled white. The umbilical wall and the peristome are white with a faint yellowish tinge, which is also the color of the interior of the aperture. Nuclear whorls decollated except for the last portion of the last turn, which is well rounded and minutely granulose. Postnuclear turns moderately well rounded, marked by rather strong, slightly wavy, almost vortical or slightly retractively curved, sublamellar axial ribs, which become fused at the summit to form strong, broad denticles which project greatly above the sutural line; 2 to 8 of the ribs may be united into a single denticle. Of the axial ribs, 37 occur on the first of the remaining turns, 41 on the second, 60 on the third, 112 on the fourth, 166 on the fifth, and 235 on the last. In addition to the axial ribs, the whorls are marked by quite strongly developed spiral cords, which render the junction with the axial ribs slightly scalloped. The spiral sculpture is absent on the first turn; on the second and third 7 cords are present, on the fourth, 9; while the fifth and last have 12. Suture strongly constricted. Periphery well rounded. Base short, well rounded, openly umbilicated, marked by the continuation of the axial ribs and 9 spiral cords, equaling those of the spire in strength. On the umbilical wall 10 spiral cords are present, which grow consecutively stronger from the inner toward the outside, and which render the axial ribs nodulose. The last whorl is solute for about one-fifth of a turn, with a decided carina at the posterior angle, above which the axial ribs extend as strong cusps. Aperture almost circular; peristome double, the inner slightly exserted and slightly reflected; the outer thickened, rather broadly expanded, fluted all around except at the posterior angle, where it forms a conspicuous auricle, and marked by concentric laminae. Operculum typically diplopomid.

The type, U.S.N.M. No. 535637, was collected by Dr. Ramsden at La Pujanza, Monte Toro, northwest of Guantánamo, Oriente Province. It has 6.2 whorls remaining and measures: Length, 21.3 mm.; greater diameter, 13.3 mm.; lesser diameter, 9.3 mm.

Its splendid size will differentiate it from all the other Diplopomas.

ANNULARIA (DIPLOPOMA) ARCHITECTONICA ([Gundlach] Pfeiffer)

Shell very elongate-conic, flesh colored, straw colored, or slightly pinkish. Nuclear whorls almost 2, well rounded, microscopically granulose, the last portion of the last turn showing the beginning of the postnuclear sculpture. Postnuclear whorls well rounded, marked by retractively slanting, rather closely spaced, somewhat wavy axial riblets, of which 4 to 10 are gathered into broad hollow cusps at the summit; these cusps are separated by narrow intervals of shorter ribs; the spiral sculpture consists of low rounded threads. Suture strongly constricted. Periphery well rounded. Base short, openly umbilicated, marked by the continuation of the axial ribs and by spiral threads. Last whorl solute for almost half a turn. The umbilical wall is marked by the continuation of the axial riblets and by spiral threads, the junctions of which here and on the anterior portion of the base form feeble scallops. Aperture broadly oval; peristome double, the inner moderately exerted and moderately reflected; the outer moderately expanded, forming a conspicuous auricle at the posterior angle. Operculum typically diplopomid.

This species occupies parts of Oriente Province, where it breaks up into the subspecies noted below.

KEY TO THE SUBSPECIES OF ANNULARIA (DIPLOPOMA) ARCHITECTONICA

Sculpture strongly developed.

Axial ribs fine and closely spaced..... libanoensis

Axial ribs not fine and more distantly spaced..... architectonica

Sculpture feebly developed..... tanamensis

ANNULARIA (DIPLOPOMA) ARCHITECTONICA LIBANOENSIS, new subspecies

PLATE 35, Figure 8

This subspecies appears to range from Monte Toro through Monte Libano to Monte Verde, north of Guantánamo, Oriente Province.

The smaller size and greater number of axial ribs will readily distinguish this from *A. (D.) architectonica architectonica*.

The type, U.S.N.M. No. 356449, was collected by Henderson and Bartsch on Guaso River, Monte Libano, Guantánamo, Oriente Province. It has a little over 4 whorls and measures: Length, 14.0 mm.; greater diameter, 7.6 mm.; lesser diameter, 5.7 mm.

ANNULARIA (DIPLOPOMA) ARCHITECTONICA ARCHITECTONICA ([Gundlach] Pfeiffer)

PLATE 35, FIGURE 3

1859. *Cyclostoma (Diplopoma) architectonicum* (Gundlach) PFEIFFER, Malakozool. Blätter, vol. 7, p. 73.

1861. *Diplopoma architectonicum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1920. *Diplopoma architectonicum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, pp. 79, 80.

This subspecies comes from the region of Yateras, northeast of Guantánamo. It is larger than *A. (D.) architectonica libanoensis* and it has the axial ribs coarser and more distantly spaced. Of these ribs, 58 occur on the first of the remaining turns, 96 on the second, 124 on the third, 162 on the fourth, and 188 on the last.

The specimen described and figured, U.S.N.M. No. 356495, is one of five received from Poey collected at Yateras by Gundlach. It has a little over 5 whorls and measures: Length, 18.2 mm.; greater diameter, 8.8 mm.; lesser diameter, 7.0 mm.

Gundlach states of this subspecies (Malakozool. Blätter, vol. 7, p. 73, 1859): "Found on cliffs at Yateras. Animal white with rosy suffusion on the neck. Feelers rose or almost cinnabar red with grayish apex. Some dark dots are present on the head."

ANNULARIA (DIPLOPOMA) ARCHITECTONICA TANAMENSIS, new subspecies

PLATE 35, FIGURE 2

This is the northern representative of the species. This race is easily distinguished from the other two by its much enfeebled sculpture.

The specimen which we have described and figured, U.S.N.M. No. 57324, was collected by Arango at Ingenio el Coco, about 3 miles southeast of Sagua de Tánamo. The type has 70 axial riblets on the first of the remaining turns, 98 on the second, 118 on the third, and 196 on the last. It has a little over 4 whorls and measures: Length, 13.0 mm.; greater diameter, 6.8 mm.; lesser diameter, 5.7 mm.

ANNULARIA (DIPLOPOMA) PILSBREYI, new species

PLATE 35, FIGURE 6

Shell small, thin, elongate-ovate, semitranslucent, straw colored; early whorls decollated, those remaining strongly rounded, marked by strong, rather distantly spaced, lamellar axial ribs, the ribs extending prominently above the suture as conspicuous expanded auricles, but not fusing into tufts. Of these ribs 34 are present on the first of the remaining turns, 95 on the second and third, 139 on the fourth, and 88 on the last eight-tenths of a whorl. The spiral sculpture is obsolete on all the turns on the spire. On the base, however, there are 6 cords, which grow consecutively stronger from the anterior backward, the last forming decided scallops. The umbilical wall is marked by 14 spiral threads, which render the axial riblets elongatedly nodulose. Suture strongly constricted, bridged over by the riblets at the summit. Periphery strongly rounded. Base moderately long, strongly rounded.

The last whorl is solute for one-fifth of a turn, the posterior angle of the solute portion is not conspicuously denticulate. Aperture broadly oval; peristome double, the inner slightly exerted; the outer broadly expanded on the outer and inner lip, less so on the parietal wall. Operculum typically diplopomid.

The type, U.S.N.M. No. 535638, was collected by Dr. Ramsden at Vereda de Mata Yeguas, Sierra de Bucuey, Oriente Province. It has 4.7 whorls remaining and measures: Length, 13.8 mm.; greater diameter, 7.0 mm; lesser diameter, 5.5 mm.

The absence of tufting at the summit, the broadly expanded outer lip, stronger axial ribs and obsolete spiral sculpture will differentiate this from the other species.

ANNULARIA (DIPLOPOMA) SONGOENSIS, new species

PLATE 35, FIGURE 5

Shell elongate-ovate, pale brown, with the early whorls chestnut-brown. Nuclear whorls decollated in all our specimens. Post-nuclear whorls strongly rounded, marked by slender, sinuous, sub-lamellar axial ribs, which are expanded at the summit but which do not form tufts. Of these, 48 occur on the first of the remaining turns, 61 on the second, 126 on the third, and 122 are on the last. In addition to this, the whorls are marked by fine spiral threads, which render the axial ribs sinuous. These are absent on the first of the remaining turns, 5 are present on the second, 8 on the third, and 9 on the last between summit and suture. Suture well constricted. Periphery well rounded. Base narrowly, openly umbilicated, marked by the continuation of the axial ribs and by 6 spiral threads. Nine additional threads, stronger than those on the base, are present on the outer two-thirds of the umbilical wall. The last whorl is solute for about one-fourth of a turn. The posterior angle, while carinated, is not marked by conspicuous auricles. Aperture broadly oval; peristome double, the inner rather strongly exerted and slightly reflected; the outer broadly expanded except on the parietal wall, where it is a little narrower, forming a feeble auricle at the posterior angle, fluted and marked by concentric laminae. Operculum typically diplopomid.

The type, U.S.N.M. No. 535639, was collected by Dr. Ramsden at Florida Blanca near Alto Songo, Oriente Province. It has 4.8 whorls remaining and measures: Length, 12.0 mm.; greater diameter, 6.6 mm.; lesser diameter, 5.3 mm.

This species belongs to the group without tufts at the summit and it is distinguished from the other members of the same group by its comparatively strong axial and spiral sculpture.

We have seen additional specimens also collected by Dr. Ramsden at La Lechuza between Ajenjibre and Joturos, Oriente Province.

ANNULARIA (DIPLOPOMA) OBSOLETA, new species

PLATE 35, FIGURE 4

Shell elongate-ovate, thin, translucent, pale yellow. Nuclear whorls decollated in our specimens. Postnuclear whorls somewhat inflated, well rounded, marked by distantly spaced axial riblets on the early turns, which on the later whorls become quite obsolete, being prominent only at the suture in the shape of slender expanded auricles. The spiral sculpture appears entirely absent. Suture well constricted. Periphery somewhat inflated, well rounded. Base moderately long, openly umbilicated, marked by a continuation of the axial ribs, and by 9 spiral threads on the umbilical wall. The last whorl is solute for about one-fourth of a turn, with a slightly denticulate carina at the posterior angle. Aperture broadly oval; peristome double, the inner moderately exerted and reflected; the outer broadly expanded, slightly fluted, and marked by concentric laminae, which are a little narrower on the parietal wall than on the rest.

The type, U.S.N.M. No. 535641, probably a male, was collected by Dr. Ramsden at La Cueva, Diego Cobas, Majaguabos, Oriente Province. It has 5 whorls remaining and measures: Length, 9.3 mm.; greater diameter, 5.7 mm.; lesser diameter, 4.2 mm.

Dr. de la Torre's collection contains another specimen from the same locality which is considerably larger, evidently a female. A female specimen, U.S.N.M. No. 535642, collected by Dr. Ramsden at Subida a La Campana por Reuter, has 4.3 whorls and measures: Length, 11.4 mm.; greater diameter, 6.5 mm.; lesser diameter, 5.2 mm.

The exceeding thinness and translucence of the shell, combined with the obsolete sculpture, will differentiate this from the other species of the genus.

JUANNULARIA, new subgenus

Annularias with elongate-ovate shell; strong sublamellar spiral cords as well as the spaces between them are crossed by numerous closely crowded, fine axial threads, which render the spiral cords finely denticulated. Peristome double. Operculum typically annularid.

Type: *Annularia* (*Juannularia*) *perplicata* (Gundlach).

KEY TO THE SPECIES OF THE SUBGENUS JUANNULARIA

Suture channeled.....	perplicata
Suture not channeled.....	arguta

ANNULARIA (JUANNULARIA) PERPLICATA (Gundlach)

PLATE 37, FIGURE 5

1857. *Cyclostoma* (*Choanopoma*) *perplicatum* GUNDLACH, Malakozool. Blätter, vol. 4, pp. 177-178.

1865. *Choanopoma perplicatum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 103.
1920. *Annularia (Annularia) perplicata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.
1924. *Chondropoma perplicatum* BAKER, Nautilus, vol. 39, p. 90.

Shell elongate-conic, pale yellow, with the early whorls pale chestnut-brown, the rest pale yellow, which is also the color of the peristome. Nuclear whorls 1.5, inflated, well rounded, microscopically granulose, forming a blunt apex. Postnuclear whorls inflated, strongly rounded, marked by slender, retractively slanting, sublamellar axial riblets, of which 96 occur on the first turn, 116 on the second, 150 on the third, and 172 on the last. The spiral sculpture consists of strong cords, of which 6 are present on the first, 7 on the second, and 8 on the remaining turns between the summit and the suture. These cords are not all of exactly the same strength or spacing. The first of them is at the summit of the turns. The axial riblets, in joining the cords, form strongly elongated, narrow nodules, while the spaces enclosed between them are more or less rectangular areas. Suture strongly constricted, channeled. Periphery well rounded. Base moderately long, well rounded, narrowly umbilicated, marked by the continuation of the axial riblets and by 5 spiral threads. Within the umbilicus are 4 additional spiral threads, which are a little less strong. The junctions of the axial riblets and spiral threads on the base and in the umbilicus also form slender nodules. The last whorl is solute for about one-sixth of a turn. Aperture broadly ovate; peristome double, the inner scarcely exerted, reflected over and appressed to the outer; the outer moderately, broadly expanded, a little narrower on the parietal wall, forming a conspicuous auricle at the posterior angle, somewhat produced at the junction of the outer and basal lip, and marked by a series of concentric lamellae. Operculum typically annularid.

U.S.N.M. No. 355893 contains 2 specimens collected by Gundlach at Cabo Cruz, Oriente Province. The larger of these we have described and figured. It has a little over 4 whorls and measures: Length, 10.2 mm.; greater diameter, 6.0 mm.; lesser diameter, 4.8 mm.

ANNULARIA (JUANNULARIA) ARGUTA Pfeiffer

Shell elongate-conic, pale yellow. Nuclear whorls a little more than 2, inflated, strongly rounded, microscopically granulose, forming a pupoid apex. Postnuclear whorls inflated, strongly rounded, marked by sublamellar, retractively slanting axial riblets. In addition to these axial riblets, the whorls are marked by strong spiral keels, of which the first at the summit is weaker than the rest. These spiral keels are separated by broad, concave channels, the width of which is about four times that of the keels. The junctions of the axial ribs

and the spiral keels form slender elongated nodules having their long axis parallel with the axial sculpture, while the spaces enclosed between them are almost impressed lines about twice as wide as the axial ribs. Suture strongly constricted, but not channeled. Periphery well rounded. Base moderately long, strongly rounded, very narrowly umbilicated, marked by the continuation of the axial ribs and by strong spiral keels; several less strong spiral keels are present within the umbilical area. Here, as on the spire, the junction of the axial and spiral sculpture forms weak tubercles. Aperture broadly oval; peristome double, the inner scarcely exerted and reflected; the outer moderately broadly expanded, a little narrower on the inner lip than the outer. Operculum typically annularid.

This species ranges through the region about Santiago, Oriente Province, and a number of the keys of the Doce Leguas group.

KEY TO THE SUBSPECIES OF ANNULARIA (JUANNULARIA) ARGUTA

Spiral cords between summit and suture 5..... *arguta*
Spiral cords between summit and suture 6..... *insularis*

ANNULARIA (JUANNULARIA) ARGUTA ARGUTA (Pfeiffer)

PLATE 37, FIGURE 4

1858. *Clenopoma argutum* PFEIFFER, Malakozool. Blätter, vol. 5, pp. 188-189.
1858. *Chondropoma argutum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 1, pp. 138-139.
1878. *Chondropoma elongatum* ARANGO, Contribucion a la fauna malacologica Cubana, p. 10.

This subspecies comes from the region of Santiago, Oriente Province. It is easily distinguished from *A. (J.) arguta insularis* by the fact that it has one less spiral keel, that is 5, between the summit and the suture, and on the base.

The specimen described and figured, U.S.N.M. No. 355896, was collected by Gundlach at Santiago. It has a little more than 4 whorls remaining and measures: Length, 9.8 mm.; greater diameter, 5.3 mm.; lesser diameter, 4.6 mm.

ANNULARIA (JUANNULARIA) ARGUTA INSULARIS, new subspecies

PLATE 37, FIGURE 6

Bartsch collected this race on Cachiboca Cay and Cayo de Cruz, both of the Doce Leguas group, off the south coast of Camagüey Province. It differs from typical *A. (J.) arguta arguta* in having the extra spiral keel between the suture and on the base. The axial riblets are also a little stronger and less closely spaced than in the typical race.

The type, U.S.N.M. No. 391832, comes from Cachiboca Cay. It has 3.9 whorls remaining and measures: Length, 10.0 mm.; greater diameter, 5.4 mm.; lesser diameter, 4.7 mm.

Subgenus ANNULARITA Henderson and Bartsch

1920. *Annularita* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

Shell ovate-conic, marked by both axial riblets and spiral threads. Peristome not expanded into a broad thin disk, but much thickened, slightly flattening to a thin edge. Operculum typically annularid.

Type: *Annularia* (*Annularita*) *majuscula* (Morelet).

ANNULARIA (ANNULARITA) MAJUSCULA (Morelet)

Shell very large, elongate-ovate, varying in color from white through flesh color to pale yellow to buff; unicolor, or banded with interrupted spiral bands of brown, zigzag or arrow-shaped markings, depending upon the race to which the subspecies in question may belong. The base is as variable in coloring as the spire; the peristome as a rule is a little paler than the rest of the shell, unicolor, or rayed. Nuclear whorls almost 2, smooth, well rounded, forming a small apex. Postnuclear whorls well rounded, marked by almost vertical or slightly retractively slanting axial riblets, which vary greatly in strength in the different races. Some of these riblets become projected and fused at quite regular intervals at the summit, lending to the summit a strongly denticulated aspect. The strength of this denticulation likewise varies materially in the different subspecies. The spiral sculpture consists of threads, which also vary from almost obsolete to quite strong in the various races. Periphery of the last whorl strongly rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial riblets or by lines of growth and spiral threads, which vary very much in strength in the different races. The umbilicus is moderately open and the umbilical wall is marked by the continuation of the axial ribs and by obsolete or a little stronger spiral threads. The last whorl may be appressed or very slightly solute at the aperture. Aperture broadly oval; peristome double, the inner reflected and appressed to the outer, sometimes almost coextensive with it; the outer moderately broadly expanded, thick, forming an inconspicuous auricle at the posterior angle, wider on the outer and basal lip than on the parietal wall, marked by concentric threads. In the male the outer lip is concave below the summit. Operculum with the nucleus halfway between subcentral and submarginal, having a strong obliquely slanting lamella, which is reinforced by oblique threads.

This species ranges over the eastern half of the mountains of Pinar del Rio Province from Guajaibón La Cumbre to Candelaria. It

breaks up into a number of subspecies in this range, descriptions of which follow:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULARITA) MAJUSCULA

Outer peristome greatly thickened.

Auricle at the posterior angle of the aperture conspicuous.

Parietal wall of aperture detached from preceding whorl..... **narcisi**

Parietal wall of aperture not detached from the preceding whorl..... **cumbrensis**

Auricle at the posterior angle of the aperture not conspicuous.

Outer peristome of inner lip broad..... **majuscula**

Outer peristome of inner lip not broad.

Outer lip very greatly thickened..... **crassilabris**

Outer lip not very greatly thickened..... **macta**

Outer peristome not greatly thickened.

Shell large, length of decollated shell more than 31 mm..... **excelsa**

Shell small, length of decollated shell less than 25 mm..... **catalinensis**

ANNULARIA (ANNULARITA) MAJUSCULA NARCISI, new subspecies

PLATE 36, FIGURE 3

This subspecies comes from the limestone blocks adjacent to Candelaria, Pinar del Rio Province. It is readily distinguished from the others by having a decided auricle at the posterior angle and by the parietal wall usually being free, leaving a depression between it and the preceding turn. The peristome of the outer lip is also immensely thickened and it extends back for some distance. By the presence of the auricle it suggests *A. (A.) majuscula cumbrensis*.

The type, U.S.N.M. No. 356227, was collected near the Escuela de Frias, Candelaria. It is an almost complete specimen having 6.0 whorls remaining and measuring: Length, 26.0 mm.; greater diameter, 14.6 mm.; lesser diameter, 12.5 mm.

ANNULARIA (ANNULARITA) MAJUSCULA CUMBRENSIS, new subspecies

PLATE 36, FIGURE 7

This race comes from La Cumbre, north of San Diego de los Baños, Pinar del Rio Province. In shape, color pattern, and thickened outer peristome it resembles typical *A. (A.) majuscula majuscula*. Its small size and rather conspicuous auricle at the posterior angle of the aperture will distinguish it from that race.

The type, U.S.N.M. No. 356206, has 3.5 whorls remaining and measures: Length, 27.0 mm.; greater diameter, 18.7 mm.; lesser diameter, 14.6 mm.

ANNULARIA (ANNULARITA) MAJUSCULA MAJUSCULA (Morelet)

PLATE 36, FIGURE 6

1851. *Cyclostoma majusculum* MORELET, Testacea novissima insulae Cubana et Americae Centralis, pt. 2, p. 19.
1852. *Choanopoma majusculum* PREIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 109.
1920. *Annularia (Annularita) majuscula* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

This subspecies was described by Morelet from Pan de Guajaibón, Pinar del Rio Province. It is a large race with greatly thickened reflected peristome. It is readily distinguished from the other race, which comes from the extreme height of Guajaibón, by its less conic form and by the thickening of the outer lip.

The specimen figured, U.S.N.M. No. 356208, one of a series, has 3.5 whorls remaining and measures: Length, 30.5 mm.; greater diameter, 19.7 mm.; lesser diameter, 15.4 mm.

ANNULARIA (ANNULARITA) MAJUSCULA CRASSILABRIS, new subspecies

PLATE 36, FIGURE 2

This race comes from Cafetal La Villa, and Rio Hondo, Lomas de Candelaria, Pinar del Rio Province. In this subspecies the outer lip is very greatly thickened, in which respect it suggests *A. (A.) majuscula narcisi*, from which, however, it can at once be distinguished by the absence of the auricle at the posterior angle.

The type, U.S.N.M. No. 356219, has 3.5 whorls remaining and measures: Length, 25.4 mm.; greater diameter, 16.9 mm.; lesser diameter, 13.7 mm.

ANNULARIA (ANNULARITA) MAJUSCULA MACTA (Poey)

PLATE 36, FIGURE 1

1852. *Cyclostoma mactum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, pp. 97, 444, pl. 8, figs. 6-12.

This race extends over the Sierra Limones and the region of Rangel and Santa Cruz River, Pinar del Rio Province. It differs from *A. (A.) majuscula majuscula* in having the outer peristome of the inner lip much narrower and not very greatly thickened.

The type, U.S.N.M. No. 566221, comes from Rangel. It has 3.5 whorls remaining and measures: Length, 27.8 mm.; greater diameter, 18.8 mm.; lesser diameter, 15.3 mm.

ANNULARIA (ANNULARITA) MAJUSCULA EXCELSA, new subspecies

PLATE 36, FIGURE 5

This race comes from the extreme height of Pan de Guajaibón, Pinar del Rio Province. It is distinguished from the typical *A. (A.) majuscula majuscula* by being much more elongate-conic, that is, slender, and by lacking the immense thickening of the peristome; in this subspecies the peristome is rather sharp.

The type, U.S.N.M. No. 535594, has 5.0 whorls remaining and measures: Length, 37.8 mm.; greater diameter, 21.5 mm.; lesser diameter, 16.8 mm.

ANNULARIA (ANNULARITA) MAJUSCULA CATALINENSIS, new subspecies

PLATE 36, FIGURE 4

This subspecies comes from La Catalina, between Pan de Guajaibón and the Sierra de La Güira, Pinar del Rio Province. We have also seen it from the Mogote del Bosque and Mogote del Indio on the east side of the Rio San Diego. It is a small race, with a thin outer peristome.

The type, U.S.N.M. No. 356215, has 3.6 whorls remaining and measures: Length, 21.1 mm.; greater diameter, 14.0 mm.; lesser diameter, 10.6 mm.

Subgenus TROSCHELVINDE H. B. Baker

1924. *Troschelvinde* H. B. BAKER, *Nautilus*, vol. 37, p. 90.

Shell elongate-conic, marked by rounded axial ribs and by spiral cords, the combination forming a fenestrated pattern. Some of the axial ribs are gathered into conspicuous tufts at the summit. Peristome double. Operculum typically annularid.

Type: *Annularia (Troschelvinde) candeana* (Orbigny).

Dr. Baker, *loc. cit.*, reestablished the fact mentioned by Troschel that the rachidian tooth of the radula in "*Cyclostoma illustre* Poey" had an extra minute denticle on each side of the central cusp, suggesting affinity with the European Pomatias. He therefore placed all of the American annularids in the family Pomatiasidae. The mere presence of an extra ultra-reduced denticle in one or two species hardly leads us to concur with him in this arrangement. Why may this not be a sport character whose variance from the norm may not represent genetic affinities? Cuba has a rather large assemblage of species which, in shape and sculpture of shell as well as in opercular characters, form a natural group. To this group we shall assign the name *Troschelvinde*.

KEY TO THE SPECIES OF THE SUBGENUS TROSCHELVINDEX

Shell cylindro-conic.

Outer peristome broadly expanded.

Outer peristome rayed..... **tracta**

Outer peristome not rayed..... **jiguanensis**

Outer peristome not broadly expanded.

Axial and spiral sculpture conspicuous..... **candearia**

Axial and spiral sculpture subobsolete..... **inculta**

Shell not cylindro-conic.

Shell elongate-conic.

Junction of axial ribs and spiral cords forming cusps..... **arangiana**

Junction of axial ribs and spiral cords not forming cusps..... **bebini**

Shell not elongate-conic but elongate-ovate.

Sculpture decidedly reduced in strength.

Tufts at the summit strongly developed..... **barbouri**

Tufts at the summit feebly developed..... **minia**

Sculpture not decidedly reduced in strength.

Inner lip of outer peristome crenulated..... **rocai**

Inner lip of outer peristome not crenulated..... **agrestis**

ANNULARIA (TROSCHELVINDEX) TRACTA ([Gundlach] Poey)

PLATE 37, FIGURE 7

1858. *Cyclostoma tractum* [Gundlach] POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 2, p. 4, *nomen nudum*.
 1858. *Cyclostoma tractum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 5, p. 45.
 1865. *Choanopoma tractum* [Gundlach] PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 102.
 1920. *Annularia (Annularia) tracta* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

Shell very cylindro-conic, flesh colored, with rather broad interrupted spiral bands of brown; the dots composing these bands are arranged in both axial and spiral series, which give to the shells a somewhat varicid appearance. Nuclear whorls decollated. Post-nuclear whorls well rounded, marked by feeble, slightly retractorily slanting axial riblets, of which two or more are gathered into hollow denticles at the summit. The spiral sculpture consists of feeble threads a little stronger than the axial ribs, of which eight are present between the summit and the suture on the last turn. The junctions of the axial ribs and spiral threads scarcely form nodules, while the spaces enclosed between them are shallow, elongated pits having their long axis parallel with the axial sculpture. Suture well constricted. Periphery strongly rounded. Base rather long, scarcely rounded, narrowly, openly umbilicated, marked by the continuation of the axial ribs and seven spiral threads, which are a trifle heavier than those on the spire. Seven additional spiral threads are present within the umbilicus. These are of about the same strength as those on the base. The spiral threads and the axial ribs on the base and in the

umbilicus form feeble nodules. Aperture subcircular; peristome double, the outer broadly expanded, somewhat auriculated at the posterior angle and adnate to the preceding turn on the parietal wall, marked by a series of concentric lamellae; the inner slightly exerted and slightly reflected. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 355878, was received from Poey and was collected by Gundlach at Guisa, Oriente Province. It has 5 whorls remaining and measures: Length, 15.4 mm.; greater diameter, 7.6 mm.; lesser diameter, 5.8 mm.

ANNULARIA (TROSCHELVINDEX) JIGUANENSIS (Pfeiffer)

Shell cylindro-conic, varying from flesh color to pale brown in ground color, with interrupted spiral bands of brown; the elements composing these bands are arranged in both axial and spiral series, but they are not regularly distributed, the spaces separating them varying greatly in width; the peristome may be rayed with brown or white, the brown markings when present coinciding with the external spiral bands, which show conspicuously in the aperture. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by slightly retractively slanting, rather closely spaced, threadlike axial riblets, of which two, three, four, or even more may be gathered together to form tufts at the summit. The spiral sculpture consists of threads about as strong as or a little stronger than the axial ribs. The junctions of these with the axial ribs form slender, elongated nodules, with their long axis parallel with the axial sculpture. These nodules lend to the axial riblets a somewhat wavy outline. The spaces enclosed between the axial riblets and the spiral threads are oval pits having their long axis parallel with the axial sculpture. Suture strongly constricted. Periphery strongly rounded. Base moderately long, well rounded, marked by spiral threads, which are a little stronger than those on the spire. Within the umbilicus additional spiral threads are present. The base is also marked by the continuation of the axial ribs, which at their junction with the spiral threads on the base and on the umbilical wall form weak nodules. Aperture broadly oval; peristome double, the inner slightly exerted and reflected; the outer well expanded, a little narrower on the parietal wall than on the rest, and slightly auriculated at the posterior angle, adnate to the outer on the outer lip.

The species is confined to Oriente Province, where it breaks up into the several subspecies here defined:

KEY TO THE SUBSPECIES OF ANNULARIA (TROSCHELVINDEX) JIGUANENSIS

Last whorl solute.....	jiguanensis
Last whorl adnate.....	
Outer peristome rayed.....	negrosensis
Outer peristome not rayed.....	bairiensis

ANNULARIA (TROSCHELVINDEX) JIGUANENSIS JIGUANENSIS (Pfeiffer)

PLATE 37, FIGURE 2

1861. *Choanopoma jiguanense* PFEIFFER, Malakozool. Blätter, vol. 8, p. 223.

1920. *Annularia (Annularia) jiguanensis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 53, p. 73.

This, the typical subspecies, comes from Jiguani, Oriente Province. It differs from *A. (T.) jiguanensis negrosensis* in being much paler and from *A. (T.) jiguanensis bairensis* in having the axial riblets more slender and less strongly developed, and in having the peristome rayed.

The specimen described and figured, U.S.N.M. No. 355882, is one of five listed under that number. It has a little more than 4 whorls remaining and measures: Length, 13.9 mm.; greater diameter, 7.3 mm.; lesser diameter, 5.6 mm.

ANNULARIA (TROSCHELVINDEX) JIGUANENSIS NEGROSENSIS, new subspecies

PLATE 37, FIGURE 8

This subspecies comes from Alto de los Negros, Sierra Maestra Oriente Province. It agrees with the typical race in having the peristome rayed, but it has the axial ribs much stronger and the last whorl not solute, but adnate, to the preceding turn. The whole color scheme presents a marbled effect, and there are decided axial, almost zigzag, fulgurations of darker brown than the general coloration. There is also a mottling of flesh color, and the denticles at the summit are white.

The type, U.S.N.M. No. 535546, has 4.9 whorls remaining and measures: Length, 14.3 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.5 mm.

ANNULARIA (TROSCHELVINDEX) JIGUANENSIS BAIRENSIS, new subspecies

PLATE 37, FIGURE 9

This subspecies comes from Baire, southeast of Jiguani, Oriente Province. It has the last whorl adnate, in which respect it agrees with *A. (T.) jiguanensis negrosensis*, but it has the ribs a little more strongly developed and it lacks the radiating rays on the outer peristome. The color scheme approximates that of the typical race, but it is a little darker.

The type, U.S.N.M. No. 535548, has almost 5 whorls remaining and measures: Length, 14.7 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.9 mm.

ANNULARIA (TROSCHELVINDEX) CANDEANA (Orbigny)

Shell cylindro-conic, varying from flesh color to pale brown in ground color, marked with interrupted spiral bands of brown, which vary materially in strength. The elements composing these bands are also arranged in axial series, so that not infrequently the axial disposition of the color bands is more pronounced than the spiral. Peristome rayed. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. The post-nuclear whorls are well rounded, marked by retractively curved axial riblets, which vary considerably in strength and spacing. These riblets may form slender hollow cusps at the summit or 2 or 3 of them may be gathered to form a stronger tuft. The spiral sculpture consists of threads equaling the riblets in strength, and the combination of the two gives to the shell a screenlike pattern. The junctions of the axial ribs and the spiral threads form scarcely perceptible nodules. Suture well constricted. Periphery well rounded. Base short, well rounded, openly umbilicated, marked by the continuation of the axial ribs and by spiral threads equaling those on the spire, which continue the same type of pattern characterizing the spire. The last whorl is usually solute, though at times the outer peristome touches the preceding whorl. Aperture broadly oval; peristome double, the inner very strongly exerted and reflected; the outer expanded, of about the same width on the outer, basal, and inner lip, but narrower on the parietal wall. The inner lip is fluted and crenulated at the edge, while at the posterior angle the outer peristome forms a moderately strong auricle. Operculum typically annularid.

This species is a rather common Cuban shell. It ranges from the eastern end of Pinar del Rio Province east to Santa Clara. Throughout its range it maintains a rather constant expression. It is only in the extreme eastern part of the range that we have sufficient differentiation to merit a subspecific designation.

This species has been responsible for considerable controversy. First of all came the question as to whether or not *candeana* and *illustris* are synonymous; then the presence of the extra rachidian denticle on the radula raised a doubt as to whether the American species should constitute a distinct family from the European; we think they should. The characters differentiating the two races which we now recognize are set forth in the key and descriptions that follow:

KEY TO THE SUBSPECIES OF ANNULARIA (TROSCHELVINDEX) CANDEANA

Denticles at summit very strongly developed.....	fallax
Denticles at summit less strongly developed.....	candeana

ANNULARIA (TROSCHELVINDEX) CANDEANA FALLAX, new subspecies

PLATE 37, FIGURE 3

This subspecies occupies the region about Sagua la Grande, Santa Clara Province. It differs from the typical species in having many more ribs and spiral threads, and in having them very closely spaced, so that the combination instead of producing a fenestrated pattern yields small rounded pits between the ribs and the spiral cords. The denticles at the summit are much more strongly developed and embrace more riblets. The peristome is usually adnate, and it is narrower than in the typical race.

The type, U.S.N.M. No. 535581, which comes from Loma Iradi at Sagua, Santa Clara Province, has 4.8 whorls remaining and measures: Length, 13.5 mm.; greater diameter, 6.2 mm.; lesser diameter, 5.4 mm,

ANNULARIA (TROSCHELVINDEX) CANDEANA CANDEANA (Orbigny)

PLATE 37, FIGURE 1

1842. *Cyclostoma candeanum* ORBIGNY, in Sagra's Histoire physique, politique et naturelle de l'Ile de Cuba, vol. 1, pp. 261-262, pl. 22, figs. 15, 17.
1852. *Cistula candeanum* PFEIFFER, Conspectus cyclostomaceorum, pp. 42, 392.
1857. *Cistula candearia* TROSCHEL, Das Gebiss der Schnecken zur Begründung einer natürlichen Classification untersucht, vol. 1, p. 75, pl. 5, fig. 1 (Radula).
1858. *Cyclostoma illustre* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, pp. 1, 33, 89.
1878. *Cistula illustris* ARANGO, Contribucion a la fauna malacologica Cubana, p. 23.
1920. *Annularia illustris* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.
1924. *Troschelvindex illustris* BAKER, Natuillus, vol. 37, p. 90.
1935. *Troschelvindex candeanum* AGUAYO, Mem. Soc. Cubana, Hist. Nat., vol. 9, pp. 1-5.

This subspecies differs from the eastern race in usually being paler. In having the outer lip more expanded, more denticulated, and usually free from the parietal wall. Also the axial ribs and the spiral threads are more distantly spaced and the denticles at the summit are less numerous.

The specimen described and figured, U.S.N.M. No. 355908, is one received from Poey. It comes from the region of Habana, the type locality. It has 5.0 whorls remaining and measures: Length, 13.0 mm.; greater diameter, 6.3 mm.; lesser diameter, 5.0 mm.

ANNULARIA (TROSCHELVINDEX) INCULTA (Poey)

PLATE 38, FIGURE 7

1851. *Cyclostoma incultum* POEY, Memorias sobre la historia natural de la isla de Cuba, vol. 1, p. 98, pl. 8, figs. 3-5.
1861. *Cistula inculta* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1863. *Chondropoma incultum* REEVE, *Conchologia iconica*, No. 63.

1920. *Annularia (Annularia) inculta* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 73.

Shell cylindro-conic, pale buff, marked by interrupted spiral bands of brown; peristome unicolor. Nuclear whorls 1.7, strongly rounded, the first one and one-fourth smooth, the rest showing the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by closely spaced, rather broad, poorly developed, retractively slanting axial riblets, of which 92 occur on the first turn, 106 on the second, 120 on the third, and 90 on the last. On the last turn they are very much enfeebled, broadened and irregular, and almost obsolete. Two, 3, or even more of the riblets become fused at the summit to form conspicuous denticles. The spiral sculpture consists of rather broad, low, poorly developed threads, of which 9 occur on the first turn, 11 on the second, and 13 on the third, while on the last they are too poorly developed to be counted. The junction of the axial ribs and spiral threads scarcely forms nodules on the early whorls. The spaces enclosed between them are either mere lines or they are narrow rectangular pits having their long axis parallel with the axial sculpture. Suture moderately constricted. Periphery inflated, well rounded. Base moderately long, narrowly, openly umbilicated, marked by the feeble continuation of the axial riblets and by 9 almost obsolete spiral threads, while within the umbilicus 10 additional feeble spiral threads are present. The last whorl is solute for about one-fifth of a turn. Aperture very broadly oval; peristome double, the inner scarcely at all exerted but strongly reflected and adnate to the outer almost entirely, except at the posterior angle; the outer only narrowly expanded, forming a feeble auricle at the summit.

The specimen described and figured, U.S.N.M. No. 535550, is one of a series collected at La Vigía, Trinidad, Santa Clara Province. It has a little over 4 whorls and measures: Length, 15.5 mm.; greater diameter, 7.9 mm.; lesser diameter, 6.5 mm.

ANNULARIA (TROSCHELVINDEX) ARANGIANA ([Gundlach] Pfeiffer)

Shell broadly elongate-conic, pale buff, variously spotted with interrupted spiral bands of brown; the dots composing these bands are not exactly arranged in axial and spiral series; peristome rayed. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by slender, retractively curved axial riblets, which may become expanded at the summit into hollow cusps, or sometimes two or more may fuse to form such a cusp. The spiral sculpture consists of slender threads, which render the axial ribs tuberculated, while the spaces enclosed between the axial ribs and the spiral threads are more or less square or rectangular areas. Suture strongly con-

stricted. Periphery well rounded. Base short, strongly rounded, openly umbilicated, marked by the continuation of the axial ribs and spiral threads. Within the umbilicus additional spiral threads considerably stronger than those on the outside are present. Aperture almost subcircular; peristome double, the inner moderately exerted and slightly reflected; the outer broadly expanded, somewhat fluted, and denticulated on the free margin. Operculum typically annularid.

Three races of this species are before us, all from Oriente Province. The following key and descriptions will help to characterize them:

KEY TO THE SUBSPECIES OF ANNULARIA (TROSCHELVINDEX) ARANGIANA

Axial ribs of last whorl very closely spaced.....	<i>arangiiana</i>
Axial ribs of last whorl less closely spaced.	
Outer peristome very strongly fluted.....	<i>cautoensis</i>
Outer peristome less strongly fluted.....	<i>magistra</i>

ANNULARIA (TROSCHELVINDEX) ARANGIANA ARANGIANA ([Gundlach])

PLATE 38, FIGURE 6

1857. *Cyclostoma (Choanopoma) aranganum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 4, p. 177.

1920. *Annularia (Annularia) arangiiana* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 53, p. 73.

The typical race comes from near Cabo Cruz, Oriente Province. It is smaller than the other two races here recognized and has the junctions of the axial ribs and spiral threads finer cusped; in that respect, it resembles *A. (T.) arangiiana magistra*. The axial ribs in this form are more closely spaced than they are in *A. (T.) arangiiana magistra*.

The specimen described and figured, U.S.N.M. No. 355887, is one of 2 collected by Gundlach at Júcaro near Cabo Cruz. It has a little more than 4 whorls remaining and measures: Length, 10.0 mm.; greater diameter, 6.5 mm.; lesser diameter, 5.7 mm.

ANNULARIA (TROSCHELVINDEX) ARANGIANA CAUTOENSIS, new subspecies

PLATE 38, FIGURE 2

1878. *Choanopoma aranganum* ARANGO, Contribucion a la fauna malacologica Cubana, p. 11, in part.

This subspecies was collected by Wright at Brazo de Cauto, Oriente Province. It is larger than the typical race, with the axial ribs much more distantly spaced and the junctions of these with the spiral threads less conspicuous. The outer peristome is conspicuously denticulated, particularly so on the outer margin of the inner lip. The denticles at the summit are also heavier than those of the typical race.

The type, U.S.N.M. No. 355888, has a little more than 5 whorls remaining and measures: Length, 13.5 mm.; greater diameter, 7.5 mm.; lesser diameter, 5.7 mm.

ANNULARIA (TROSCHELVINDEX) ARANGIANA MAGISTRA, new subspecies

PLATE 38, FIGURE 4

We have seen this race from Loma del Gato and from Buena Vista, south of Bayamo, both in the Sierra Maestra. It differs from the typical race in being much more conspicuously spinulose at the junctions of the axial riblets and spiral cords, and in having the outer peristome much more strongly fluted and much more denticulated on the inner lip.

The type, U.S.N.M. No. 535551, which comes from the Loma de Gato, has 5.6 whorls remaining and measures: Length, 12.8 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.3 mm.

ANNULARIA (TROSCHELVINDEX) BEBINI (Arango)

PLATE 38, FIGURE 9

1865. *Choanopoma bebinii* ARANGO, in Pfeiffer, *Monographia pneumonopomorum viventium*, suppl. 2, pp. 100-101.

1920. *Annularia (Annularia) bebinii* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 73.

Shell very elongate-conic, flesh colored, with irregular dots and streaks of brown, the heaviest of which are usually on the spiral threads; the decollated end is brown and the peristome is conspicuously rayed with brown, corresponding to the dark spiral lines which are conspicuously shown within the aperture; the nuclear whorls are chestnut brown at the suture. Nuclear whorls 2.2, rather large, inflated, strongly rounded, forming a rather blunt apex, microscopically granulose except for the last part, which shows the beginning of the postnuclear sculpture. Postnuclear whorls moderately well rounded, marked by slender, retractively slanting, rather closely spaced axial riblets, of which 2 or 3 become fused into small denticles at the summit. The spiral sculpture consists of spiral threads, which are a little stronger than the axial ribs. Of these 15 occur between the summit and the suture on the last turn. The junction of the axial riblets and the spiral threads does not form conspicuous nodules, but the pits between them give to the whorl a somewhat fenestrated pattern. Suture strongly constricted. Periphery of the last whorl strongly inflated, well rounded. Base rather short, moderately rounded, marked by the continuation of the axial riblets and 8 spiral threads. Eight additional spiral threads are present on the umbilical wall. The latter are a little stronger than those on the outside, while

those on the base are a little weaker than those on the spire. Aperture very broadly ovate; peristome double, the inner slightly exerted and reflected, and fused with the outer on the outer and the basal lip; the outer narrowly expanded, a little narrower on the parietal wall than on the rest, adnate to the preceding turn. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 355877, is a cotype collected by Arango at Lomas del Cuzco, Pinar del Rio. It has a little over 4 whorls and measures: Length, 13.7 mm.; greater diameter, 8.3 mm.; lesser diameter, 6.2 mm.

ANNULARIA (TROSCHELVINDEX) BARBOURI, new species

PLATE 38, FIGURE 5

Shell elongate-ovate, of flesh-colored ground color, marked by interrupted spiral bands of brown. The spots composing these give one the impression of ink spots diffusing laterally; that is, they are not sharply cut at the border. Nuclear whorls almost 2, well rounded, microscopically granulose, forming a slightly blunt, tapering apex. Postnuclear whorls increasing rapidly in size, inflated, strongly rounded, and marked by slightly retractively slanting axial ribs, which are very faint on the middle of the turns, where they are almost obsolete, but which form very conspicuous, hollow tufts at the summit, either individually or by the diffusion of several riblets. The spiral sculpture consists of slender threads, which are also obsolete, and they look almost as if they were in the interior of the shell substance. The combination of the axial riblets and the spiral threads forms a netlike pattern. Suture channeled. Periphery decidedly inflated, strongly rounded. Base short, openly umbilicated, strongly rounded, marked by spiral threads, which increase in strength from the periphery anteriorly. The umbilicus is marked by the feeble continuation of the axial riblets, which are narrower at this point, and by a series of spiral cords, which increase in size from within toward the outside; the last two bordering the umbilicus are much stronger than the rest. Aperture broadly oval; peristome double, the inner exerted and slightly reflected; the outer broadly expanded, somewhat fluted and crenulated on the inner lip, forming a very conspicuous auricle at the posterior angle, and marked by concentric laminae. Operculum typically annularid.

The type, U.S.N.M. No. 535554, was collected by Drs. de la Torre and Barbour at Mina de Pozo Prieto, Alto de los Negros, Sierra Maestra. It is a complete specimen of 6.6 whorls and measures: Length, 14.3 mm.; greater diameter, 8.6 mm.; lesser diameter, 7.0 mm.

ANNULARIA (TROSCHELVINDEX) MINIA ([Gundlach] Poey)

PLATE 38, FIGURE 1

1858. *Cyclostoma minium* [Gundlach] POEY, *Memorias sobre la historia natural de la isla de Cuba*, vol. 2, p. 4.
1861. *Choanopoma minium* BLAND, *Ann. Lyceum Nat. Hist. New York*, vol. 7, p. 27.
1920. *Annularia* (*Annularia*) *minium* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 73.

Shell thin, elongate-ovate, pale orange with the spiral bands flecked here and there with white; the cusps at the summit and the peristome are yellowish white. Nuclear whorls 2, well rounded, smooth, forming a rather high apex. Postnuclear whorls inflated, strongly rounded, marked by almost vertical axial riblets, which vary considerably in strength, and of which 2 or more unite at the summit into a slender hollow cusp. The spiral sculpture consists of slender threads, of which 9 occur between the summit and the suture on the last turn. The junctions of the axial riblets and spiral threads scarcely form nodules, but the impressed spaces between them give the shell an almost malleated aspect. Periphery strongly rounded. Base moderately long, strongly rounded, marked by the continuation of the axial riblets and by 8 spiral threads. Eight additional spiral threads are present on the umbilical wall, of which the outer 2 are much stronger than the rest. The last whorl is decidedly solute for about one-sixth of a turn. Aperture very broadly oval; peristome double, the inner slightly exerted and slightly reflected; the outer well expanded all around except on the parietal wall, where it is rather narrow, forming a conspicuous auricle at the posterior angle. The outer peristome is marked by thin, concentric lamellae. Operculum typically annularid.

U.S.N.M. No. 355870 is a cotype collected by Gundlach at Guisa, Bayamo, Oriente Province. It has a little over 6 whorls remaining and measures: Length, 14.8 mm.; greater diameter, 8.2 mm.; lesser diameter, 6.2 mm.

ANNULARIA (TROSCHELVINDEX) ROCAI, new species

PLATE 38, FIGURE 3

Shell elongate ovate, of yellowish flesh color, with interrupted spiral bands of brown. Nuclear whorls thin, translucent, only the last one, which is smooth, remaining. Postnuclear whorls marked by numerous very narrow, slender, sublamellar axial riblets, of which 47 occur on the first turn and 120 on the last. In addition to this, the whorls are marked by spiral threads, of which the first 2 at the summit are much stronger than the rest. Here they cause the axial riblets to become somewhat expanded and reflected upward, while the rest cause the junctions of the two to form not very strong, elongated nodules, the long axis of which corresponds to the axial sculpture.

Of these spiral cords 11 are present between the summit and the periphery on the last whorl. Suture strongly constricted. Base short, inflated, strongly rounded, and marked by the continuation of the axial ribs, which extend into the umbilicus, becoming narrower, more lamellar, and more closely approximated on the umbilical wall. On the base 9 spiral cords are present, which also render the intersection with the ribs nodulose. The umbilical area is marked by 11 spiral cords, which cause the axial riblets at their junction with the cords to form very conspicuous, narrow, clawlike denticles. The umbilicus is open and the last whorl is solute for about one-fifth of a turn. Aperture broadly oval; peristome double, the inner slightly exerted and reflected, and adnate to the outer on the outer and basal lips; less so on the inner lip. The outer peristome is broadly expanded, a little narrower at the junction of the basal and inner lips, decidedly fluted on the inner lip, conspicuously crenulated at its outer margin, forming a very strong reflected auricle at the posterior angle, and marked by concentric laminae.

The type, U.S.N.M. No. 535557, was collected by Father Roca at Las Barraqueras, Hongolosongo, Oriente Province. It has 4.9 whorls remaining and measures: Length, 16.5 mm.; greater diameter, 10.3 mm.; lesser diameter, 7.8 mm.

ANNULARIA (TROSCHELVINDEX) AGRESTIS (Pfeiffer)

PLATE 38, FIGURE 8

1862. *Cistula agrestis* PFEIFFER, Malakozool. Blätter, vol. 7, p. 216.

Shell rather stout, elongate-ovate, of buff color with obsolete, interrupted spiral bands. Nuclear whorls decollated. Postnuclear whorls strongly inflated and strongly rounded, marked by somewhat irregular, retractively slanting, slender axial riblets, which are moderately distantly spaced on the early turns, but which become more crowded as the shell increases in size. Of these riblets 76 occur on the first turn, 98 on the second, 114 on the third, and 156 on the last. At irregular intervals some of these riblets become expanded into hollow denticles at the summit, or 2 or 3 of them may join together to form a stronger denticle. The spiral sculpture consists of moderately broad threads, of which 9 occur on the first and second, 13 on the third, and 14 on the last turn between the summit and the suture. The junctions of the axial ribs and spiral cords form rather strong tubercles. The spiral threads are not all of the same strength, and the resulting tubercles therefore also differ in strength. Suture strongly constricted. Periphery strongly rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial ribs, which extend into the umbilicus, and by 7 spiral threads of about the same strength as those on the spire, .

Within the umbilicus 9 additional spiral threads of almost the same strength are also present. On the base and in the umbilicus the junction of the axial riblets and spiral threads produces weak nodules. Aperture broadly oval; peristome double, the inner rather strongly exerted and slightly reflected; the outer thick, broadly expanded and reflected, narrower on the parietal wall than on the rest of the shell and marked by a series of concentric lamellae. Operculum ?

The specimen described and figured, U.S.N.M. No. 355892, a cotype, was collected by Gundlach at Rio Seco, Pico Turquino, Oriente Province, the type locality. It has 4.5 whorls and measures: Length, 14.0 mm.; greater diameter 8.1 mm.; lesser diameter, 6.6 mm.

Subgenus BLAESOSPIRA Crosse

1890. *Blaesospira* CROSSE, Journ. Conchyl, vol. 38, p. 280.

Shell ranging from ovate-conic to corkscrew-shaped. All of the postnuclear whorls or only the last part of the last turn solute. The axial sculpture consists of slender lamellar ribs, upon which at regular intervals hollow spines are located. This regular disposition of the spines suggests spiral sculpture, which, however, is not apparent in the intercostal spaces. The intercostal spaces are marked by a varying number of axial threads, which range in strength from mere hairlines to slender lamellae. Operculum with a strongly elevated multispiral lamella, which is slightly outbent at the free edge. The nucleus of the turns is subcentral.

Type: *Blaesospira echinus* ([Wright] Pfeiffer).

The genotype was brought to the attention of collectors by Charles Wright, who distributed specimens far and wide with the designation "Viñales." Until comparatively recently, subsequent collectors failed to rediscover it. The National Museum collection contains a large series of specimens from American collectors, as well as from foreign collectors, but all of these had their source in Wright's collecting. Recently Dr. de la Torre's collectors have discovered this species on El Queque, and we are giving a figure of the El Queque specimens, as well as a figure of a specimen collected by Wright to show that they are consubspecific.

We have likewise two collectings from the Sierra del Infierno, evidently from two different places, as they show subspecific differentiation, which we are here recognizing. In this connection let us mention that Father Roca also obtained a distinct species in the Sierra San Andres, which we diagnose here, also.

KEY TO THE SPECIES OF THE SUBGENUS BLAESOSPIRA

Spiral rows of strong spines 4.....	echinus
Spiral rows of strong spines 3.....	rocai

ANNULARIA (BLAESOSPIRA) ECHINUS ([Wright] Pfeiffer)

Shell decidedly solute in all the postnuclear whorls, ranging in color from yellowish white to pale buff, with the hollow spines and the peristome a little paler. Nuclear whorls 2, well rounded, smooth, not solute, forming a pupoid apex. Postnuclear whorls forming an openly coiled tube with 4 rows of strongly elevated, thin, hollow spines between the summit and the umbilicus; these spines are arranged in axial as well as in spiral series, and they are connected axially by slender threads, which pass up on the sides of the spines. The spines are very thin and oval in cross-section. There are also feeble threads on the lateral sides of the spines. Between the spines, 4 to 7 slender axial threads are present, which are of about the same strength and spacing. The stronger axial threads upon which the spines are placed are also well developed on the parietal wall, and the finer threads between them are of the same strength here as on the rest of the whorls. Aperture circular; peristome double, the inner slightly exerted, scarcely reflected; the outer expanded into fimbriations, which are strongest on the outer wall corresponding with the stronger spines; on the parietal wall they are more feeble and the spaces between them are less broadly expanded. Operculum with subcentral nucleus and a strong lamella rising almost vertically from the outer edge of the turns to considerable height, slightly reflected at the free margin and marked by obliquely slanting threads.

We are recognizing three subspecies, which the following key and descriptions will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (BLAESOSPIRA) ECHINUS

Digitations of the outer lip very strongly developed.

Digitations on the parietal lip well developed..... **echinus**

Digitations on the parietal lip feeble..... **lucifer**

Digitations of the outer lip not very strongly developed..... **infernalis**

ANNULARIA (BLAESOSPIRA) ECHINUS ECHINUS ([Wright] Pfeiffer)

PLATE 39, FIGURES 1, 2

1864. *Cyclostoma (Choanopoma) echinus* [Wright] PFEIFFER, Malakozool. Blätter, vol. 11, p. 102.

1865. *Choanopoma echinus* (Wright) PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 106.

1890. *Blaesospira echinus* CROSSE, Journ. Conchyl., vol. 38, p. 282, pl. 5, fig. 3.

This subspecies comes from the north side of El Queque, sometimes spoken of as Ensenada del Grillo, Palmarito. It has the digitations of the outer lip very strongly developed. Those on the inner and parietal lip are also well developed and in this respect this subspecies differs from *A. (B.) echinus lucifer*, where the converse is true.

Wright's specimen, U.S.N.M. No. 11022, has 2.3 whorls remaining and measures: Length, 6.9 mm.; greater diameter, 5.8 mm.; lesser

diameter, 4.5 mm. A complete specimen, U.S.N.M. No. 468839, with the nucleus and 4.4 whorls, measures: Length, 10.8 mm.; greater diameter, 7.0 mm.; lesser diameter, 6.0 mm.

ANNULARIA (BLAESOSPIRA) ECHINUS LUCIFER, new subspecies

PLATE 39, FIGURE 4

This subspecies comes from the Sierra del Infierno. It is a pale race, quite slender, with strong digitations on the outer and basal lip and feeble ones on the parietal lip.

The type, U.S.N.M. No. 535591, has 2.1 whorls remaining and measures: Length, 8.1 mm.; greater diameter, 7.0 mm.; lesser diameter, 5.7 mm.

ANNULARIA (BLAESOSPIRA) ECHINUS INFIERNALIS, new subspecies

PLATE 39, FIGURE 3

This subspecies also comes from the Sierra del Infierno. It is a buff-colored race with the digitation of the outer lip not strongly developed, while the digitation of the inner lip almost equals that of the outer lip.

The type, U.S.N.M. No. 535590, has 2.3 whorls remaining and measures: Length, 7.5 mm.; greater diameter, 6.1 mm.; lesser diameter, 4.0 mm.

ANNULARIA (BLAESOSPIRA) ROCAI, new species

PLATE 39, FIGURE 5

Shell of buff color, with all the postnuclear whorls solute. Nuclear whorls decollated in all our specimens. Postnuclear whorls strongly rounded, marked by distantly spaced, slender axial riblets, which bear 3 long, laterally compressed, hollow spines on each turn between the summit and the base. The intercostal spaces are marked by slender axial hairlines. The parietal wall bears mere indications of feeble spinules placed on the same axial element upon which the heavier spines are placed on the spire. Here these lamellae are very poorly developed, while the spaces between them are crossed by the same threadlike elements described for the spire. Aperture circular; inner peristome slightly solute and slightly reflected; the outer marked by digitations of which the 3 on the outer lip are stronger than the rest. There are 7 others covering the left basal portion, the inner and parietal lip. These digitations are marked by feeble concentric laminations.

This species was collected by Father Roca at Sitio de la Sierra, north side of Sierra de San Andres. We take pleasure in naming this for him. It is easily distinguished from the other species by the fact that it has one less series of spines on the whorls.

The type, U.S.N.M. No. 535592, has 2.3 whorls remaining and measures: Length, 8.0 mm.; greater diameter, 6.0 mm.; lesser diameter, 5.2 mm.

GUAJAIBONA, new subgenus

Shell ovate-conic, sculpture like *Blaesospira*, but with only the last part of the last whorl solute.

Type: *Annularia* (*Guajaibona*) *pretrei* d'Orbigny.

ANNULARIA (GUAJAIBONA) PRETREI (Orbigny)

PLATE 39, FIGURE 7

1842. *Cyclostoma pretrei* ORBIGNY, in Sagra's *Histoire physique, politique et naturelle de l'Ile de Cuba*, vol. 1, p. 260, pl. 22, figs. 9–11.

1850. *Choanopoma pretrei* GRAY, *Nomenclature of molluscos animals and shells in the collection of the British Museum*, p. 51.

1916. *Annularia pretrei* HENDERSON, *Cruise of the Tomas Barrera*, p. 281.

1920. *Blaesospira pretrei* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 74.

Shell broadly conic, thin, yellowish white, with the nuclear tip suffused with orange; peristome yellowish white, faintly rayed with brown in the depressions of the outer lip. Nuclear whorls 2.3, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the axial sculpture. Postnuclear whorls inflated, strongly rounded, marked by rather strong, more or less distantly but irregularly spaced, lamellar axial ribs, which bear slender hollow tubercles. Of these tubercles 5 are present on the first and second turns between the summit and the periphery, and 6 are on the last. The spaces between these stronger riblets are marked by slender, wavy axial threads, which vary in number and spacing. In some spaces only 2 occur, between the stronger ribs, while in others as many as 7 are present. Suture strongly constricted. Periphery inflated, strongly rounded. Base broadly, openly umbilicated, marked by the continuation of the axial sculpture, which extends strongly over the base into the umbilicus, where it becomes somewhat enfeebled. On the base the stronger riblets bear 6 spines, of which the outer 4 are heavier than the rest, the fifth being very slender, while the sixth series marks the edge of the umbilicus. On the umbilical wall 5 rows of feeble spines are present. Aperture circular; peristome double, the inner moderately exerted; the outer broadly expanded on the outer and basal lip and fluted, less strongly expanded on the inner lip, and marked all around by feeble, concentric lamellae. Operculum with subcentral nucleus, bearing a strong calcified spiral lamella, which rises slightly obliquely from the basal plate and which is slightly out-bent at the outer margin.

Gundlach says of this species (Malakozool. Blätter, vol. 3, p. 124, 1856): "The animal is pale with still lighter dots; the anterior portion of the neck and head are dark, and the feelers of the same color as the body."

This species comes from Pan de Guajaibon, Pinar del Rio. The specimen described and figured is one of a series, U.S.N.M. No. 11023, collected by C. Wright. It has 5.7 whorls and measures: Length, 7.9 mm.; greater diameter, 6.8 mm.; lesser diameter, 5.3 mm.

SUBANNULARIA, new subgenus

Small elongate-conic shells, having slender lamellose or sublamellar axial ribs, which on all the whorls, or only on the early ones, bear slender, elongated nodules at regularly spaced intervals. These nodules give an appearance of spiral threads on the spire, which is an illusion, for none are apparent in the intercostal spaces. Some of the axial ribs terminate as individual cusps, or several of them may become fused into a cusp at the summit. Last whorl solute. Peristome double. Operculum with a very oblique, strong lamella, whose outer edge does not extend to the outer limit of the whorls of the basal plate, which leaves the turns well separated. The lamella is marked by slender, retractively curved lamellae.

Type: *Annularia* (*Subannularia*) *storchii* (Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS SUBANNULARIA

Outer, basal, and inner lip of outer peristome crenulated.

Axial ribs very slender..... *lachneri*

Axial ribs not very slender..... *jeannereti*

Outer, basal, and inner lip of outer peristome not crenulated..... *storchii*

ANNULARIA (SUBANNULARIA) LACHNERI (Pfeiffer)

PLATE 39, FIGURE 9

1861. *Choanopoma lachneri* PFEIFFER, Malakozool. Blätter, vol. 8, p. 223.

1920. *Annularia* (*Annularia*) *lachneri* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

Shell small, elongate-conic, flesh colored. Nuclear whorls decolored in all our specimens. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, wavy, threadlike axial riblets, which are more or less grouped in series. The series do not possess a definite number of these threads. Of these riblets 52 occur on the first whorl, 76 on the second, 86 on the third, and 104 on the last. The spiral sculpture consists of very fine microscopic striations, which are best seen between the riblets. Suture strongly constricted. Periphery inflated, strongly rounded. Base moderately long, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial riblets and by 5 obsolete spiral threads on the umbilical wall. Last whorl solute for a little more than half a turn.

Aperture almost subcircular; peristome double, the inner slightly exerted and slightly reflected; the outer broadly expanded on the outer and basal lip and narrower on the parietal wall, decidedly auriculated at the posterior angle and very strongly fluted on the inner lip, marked by a series of concentric laminae. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 10995, is one of 6 collected by C. Wright at La Catalina, Sagua de Tanamo, Oriente Province. It has a little over 4 whorls remaining and measures: Length, 8.5 mm.; greater diameter, 4.4 mm.; lesser diameter, 3.4 mm.

ANNULARIA (SUBANNULARIA) JEANNERETI (Pfeiffer)

PLATE 39, FIGURE 6

1861. *Ctenopoma jeannereti* PFEIFFER, Malakozool. Blätter, vol. 8, p. 223.

1920. *Parachondria (Parachondrops) jeannereti* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 67.

Shell small, elongate-conic, pale yellow. Nuclear whorls 2, inflated, strongly rounded, microscopically granulose, forming a pupoid apex. Postnuclear whorls somewhat inflated, strongly rounded, marked by rather strong, slightly retractively curved, axial riblets, which become slightly expanded at the summit, or several of them may become fused to form a hollow cusplike element. These ribs are not of the same strength, but at irregular intervals they become intensified, with smaller ribs between them, which gives the shell a somewhat scalari-form appearance. The riblets are nodulose at regular intervals, which gives the shell the appearance of having spiral cords, a fact not borne out in the intercostal spaces. Of the axial ribs 31 are present on the first whorl and 88 on the last turn. Suture strongly constricted. Periphery well rounded, marked by the continuation of the axial ribs, which cross the base, which is marked by 3 rather strong spiral cords, which form narrow, well elevated tubercles at their junction with the axial ribs. Last whorl solute for one-fourth of a turn, without spiral sculpture on the umbilical wall. Aperture broadly oval; peristome double, the inner moderately exerted and reflected; the outer broadly expanded except at the parietal wall, somewhat fluted and slightly denticulated at the edge.

The specimen described and figured, U.S.N.M. No. 355386, is a cotype received by Dr. de la Torre from Jeanneret who secured it on Monte Líbano, near Guantánamo City, Oriente Province. It has 5.1 whorls remaining and measures: Length, 7.7 mm.; greater diameter, 3.4 mm.; lesser diameter, 3.0 mm.

We have quite a series of specimens from the same region, which were collected by Henderson and Bartsch.

ANNULARIA (SUBANNULARIA) STORCHI (Pfeiffer)

Shell very elongate-conic, varying in color from flesh color to pale brown. Nuclear whorls 2, inflated, strongly rounded, smooth, forming a mammillated apex. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting axial riblets, which vary in spacing from closely approximated to a separation by a space about the width of the riblet in the different subspecies. These riblets may become expanded at the summit to form hollow blisterlike denticles; at times 2 or more of these may become fused in this effort. At regular intervals these riblets bear slender nodules, which give the whorls the appearance of having spiral threads but which are not present in the intercostal spaces. Suture strongly constricted. Periphery inflated, strongly rounded. Base broadly, openly umbilicated, marked by the continuation of the nodulose axial riblets. The last whorl is solute for almost half a turn. Aperture very broadly oval; peristome double, the inner is moderately exerted and scarcely reflected; the outer moderately, broadly expanded, usually auriculated at the posterior angle, where the auricle is bent back in some of the subspecies to almost form a channel; the outer lip is a little narrower on the parietal wall than on the rest of the peristome, and is marked by a series of concentric lamellae. Operculum typically annularid.

This species occupies the region about Cayo del Rey, Mayari, Oriente Province, where it appears to break up into two subspecies, characterized here.

KEY TO THE SUBSPECIES OF ANNULARIA (SUBANNULARIA) STORCHI

Axial ribs strong and rather stout.....	nipensis
Axial ribs not strong and rather fine.....	storchi

ANNULARIA (SUBANNULARIA) STORCHI NIPENSIS, new subspecies

PLATE 39, FIGURE 8

This subspecies comes from the Farallones de Nipe, near Sabanilla. It differs from the typical race in having the ribs much larger, fewer, and a little more distantly spaced, and in having the denticles at the summit much more pronounced.

The type, U.S.N.M. No. 355883, has a little more than 5.0 whorls remaining and measures: Length, 9.3 mm.; greater diameter, 4.1 mm.; lesser diameter, 3.3 mm.

ANNULARIA (SUBANNULARIA) STORCHI STORCHI (Pfeiffer)

PLATE 39, FIGURE 10

1861. *Choanopoma storchi* PFEIFFER, Malakozool. Blätter, vol. 8, pp. 222-223.
 1920. *Annularia (Annularia) storchi* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

The type of this subspecies was collected by Wright at Cayo del Rey, Oriente Province. This subspecies differs from *A. (S.) storchi nipensis* in having the axial ribs much smaller and more closely spaced, and the denticles at the summit much less strongly developed.

The specimen described and figured, U.S.N.M. No. 11001, is one collected by Wright at Cayo del Rey. It has a little more than 5.0 whorls remaining and measures: Length, 8.6 mm.; greater diameter, 3.8 mm.; lesser diameter, 3.1 mm.

Subgenus ANNULARISCA Henderson and Bartsch

1920. *Annularisca* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 72.

Shell depressed-helicoid, widely, openly umbilicated, marked by axial riblets on spire and base. Spiral sculpture absent, or restricted to the umbilical wall, or sometimes consisting of microscopic lines.

Type: *Annularia (Annularisca) eburnea* ([Gundlach] Pfeiffer).

KEY TO THE SPECIES OF THE SUBGENUS ANNULARISCA

Spiral sculpture absent.

Interior of aperture white..... **eburnea**

Interior of aperture chestnut brown..... **prestoni**

Spiral sculpture present.

Umbilical wall with spiral threads.

Shell decidedly depressed.

Spiral sculpture on spire present..... **aberrans**

Spiral sculpture on spire absent.

Interior of aperture orange..... **auricoma**

Interior of aperture pale..... **pallens**

Shell moderately elevated.

Axial ribs rounded..... **alata**

Axial ribs sharp..... **tacrensis**

ANNULARIA (ANNULARISCA) EBURNEA ([Gundlach] Pfeiffer)

PLATE 41, FIGURES 4-6

1858. *Choanopoma eburneum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 5, p. 188.

1862. *Cyclostoma eburneum* REEVE, Conchologia iconica, No. 159.

1920. *Annularia (Annularisca) eburnea* HENDERSON and BARTSCH, Proc. U. S., Nat. Mus., vol. 58, p. 72.

Shell very depressed-helicoid, very broadly openly umbilicated, milk-white. Nuclear whorls almost 2, well rounded, microscopically granulose, forming a depressed spire. Postnuclear whorls strongly rounded, marked by slightly retractorily curved, fairly regularly spaced axial threads only. Suture strongly impressed. Periphery of the last whorl well rounded, the basal portion of the whorls well rounded, all of the turns showing to the apex in the broad, open umbilicus, marked by the continuation of the axial riblets, which

extend over the umbilical wall. No spiral sculpture whatsoever is present. Aperture broadly oval; peristome simple, except at the posterior angle, where a shelf bridges across the slight auricle, which suggests an inner peristome; the outer lip is moderately broadly expanded, while the inner is narrow. Operculum almost subcircular, with subcentral nucleus; the calcified, thin, but very broad lamella rises slightly obliquely from the chondroid basal plate; this lamella is marked by slightly curved incremental lines.

The specimen described and figured, U.S.N.M. No. 355899, is one received from Gundlach. It has 4.0 whorls and measures: Length, 7.1 mm.; greater diameter, 13.9 mm.; lesser diameter, 10.7 mm. While this shell is marked "Cuba," it is more than probable that it came from the type locality.

Gundlach says of this species: (Malakazool. Blätter, vol. 5, p. 188; 1858): "On limestone cliffs in the Cafetal Santa Maria, District Ramon (Oriente Province). Animal light gray with olive colored sheen; small whitish dots form spots on the sides of the foot and almost cover the neck. Tentacles white at the base, the rest ochre colored. One can see the dark gray or marbled intestines shine through the shell. While creeping, the shell is held almost horizontal."

ANNULARIA (ANNULARISCA) PRESTONI Ramsden

PLATE 40, FIGURES 1-3

1914. *Annularia eburnea prestoni* RAMSDEN, Nautilus, vol. 28, p. 50.

Shell depressed-helicoid, flesh colored, with livid blotches and areas, and toward the aperture with a tinge of brown. The edge of the peristome is white; behind the edge of the peristome, within the aperture, there is a broad zone of chestnut brown, which gradually fades backward. Nuclear whorls 1.5, small, well rounded, microscopically granulose. Postnuclear whorls somewhat inflated, well rounded, marked by retractively curved, slender axial riblets, which gradually gain in strength as the shell increases in size. These riblets are about as wide as the spaces that separate them, and they extend over the strongly rounded periphery, base, and over the umbilical wall. Base very broadly openly umbilicated, showing all the whorls within. Aperture very broadly oval; peristome simple?, the outer lip broadly expanded, forming an auricle at the posterior angle; the inner lip very narrow. There is a shelf which stretches across the base of the auricle, leaving a free space behind, which might indicate a possible double peristome. Operculum with almost central nucleus, and broadly, obliquely flaring lamella, which is marked by fine recurved threads.

The specimen figured, U.S.N.M. No. 535601, a topotype, was collected by Dr. Charles T. Ramsden on the Ojo de Agua Range, between

Guantánamo and Ramón de las Yaguas, 9 leagues from the former and 4 leagues from the latter. It has 4.4 whorls remaining and measures: Length, 7.5 mm.; greater diameter, 17.9 mm.; lesser diameter, 13.6 mm. The species can at once be differentiated from *A. (A.) eburnea* by the brown coloration of the interior of the aperture, and by the heavier and more pronounced axial ribs.

ANNULARIA (ANNULARISCA) ABERRANS, new species

PLATE 41, FIGURES 1-3

Shell helicoid, bright straw yellow, marked with diaphanous whitish spots and more or less zigzag or vermiculated lines of brown, much paler on the under side than on the upper; the peristome is white; the interior of the aperture is orange. Nuclear whorls 1.5, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by strongly, retractively slanting narrow, almost sharp axial riblets, which on the early whorls are about as wide as the spaces that separate them. On the last turn they are a little closer spaced; at irregular intervals these riblets become enfeebled and more closely grouped, indicating resting stages. The intercostal spaces under high magnification show incised spiral lines, which are irregularly developed and disposed. Suture strongly constricted. Periphery well rounded. Base short, inflated, strongly rounded, openly umbilicated, marked by the continuation of the axial ribs and by incised spiral lines. On the umbilical wall the axial ribs become closely approximated; here, also, 12 raised spiral threads are present, which render the riblets feebly nodulose. Aperture subcircular; peristome double, the outer and inner fused except for an indication of separation at the posterior angle. Operculum typically annularid.

The type, U.S.N.M. No. 25100, was collected by C. Wright at Monte Verde, northeast of Guantánamo, Oriente Province. It has a little over 3 whorls and measures: Length, 10.4 mm.; greater diameter, 14.9 mm.; lesser diameter, 11.8 mm.

ANNULARIA (ANNULARISCA) AURICOMA ([Gundlach] Pfeiffer)

Shell depressed-helicoid, flesh colored, marked with hydrophanous spots, which sometimes give to the surface of the shell a painted or vermiculated, blotched or spotted appearance; the early whorls are usually a little darker than the rest, while the base is usually paler than the upper half; the peristome is white and the interior of the aperture is orange, densest at the junction of the white zone of the peristome and of the colored interior. Nuclear whorls almost 2, well rounded, smooth, except for the last portion of the last turn,

which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by rather coarse, more or less regular, retractorily slanting, low, rounded axial riblets, which are always broader than the spaces that separate them; in addition to this there is an indication of rather broad obsolete spiral threads. Suture narrowly channeled; periphery well rounded. Base short, very broadly openly umbilicated, marked by the continuation of the axial ribs and by indications of obsolete spiral threads; the umbilical wall is marked by the continuation of the axial riblets and by spiral threads, which vary in number and strength in the two races here recognized. Aperture broadly oval; peristome double, the inner and outer co-extensive and fused, separated by a mere line except at the posterior angle where the separation is a little more marked; the fusing of the two peristomes is so complete as to lead one easily to mistake it for a simple structure. Operculum typically annularid.

This species comes from the environs of Guantánamo Bay and extends eastward to the mouth of the Yateras River.

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULARISCA) AURICOMA

Axial ribs depressed.....	auricoma
Axial ribs not depressed.....	putre

. ANNULARIA (ANNULARISCA) AURICOMA AURICOMA ([Gundlach] Pfeiffer)

PLATE 42, FIGURES 4-6

1859. *Cyclostoma auricomum* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6 pp. 71-72.
 1862. *Choanopoma auricomum* PFEIFFER, Novitates-conchologicae, vol. 2, pp. 194-195, pl. 51, figs. 19-21.
 1920. *Tudora (Tudorellata) auricoma* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 76.

Henderson and Bartsch gathered this subspecies in immense quantities from the various digitations and rocky cliffs jutting out into Guantánamo Bay. Here specimens were found under rocks and other objects, which sheltered them from the sun's rays and from hot winds.

These gatherings present some interesting variations in size and color and would furnish a splendid subject for a biometrist.

Our specimens, gathered on a hillside 1 mile from the Amusement House on the Boquerón Trail, agree most nearly with Gundlach and Pfeiffer's descriptions and measurements. One hundred of these yield the following measurements:

	Length	Greater diameter	Lesser diameter
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Greatest.....	11. 8	17. 7	15. 4
Least.....	8. 0	13. 3	11. 0
Average.....	9. 7	15. 3	13. 0

The specimen figured is U.S.N.M. No. 356352.

One hundred specimens from the small island at the head of Cumberland Inlet measure:

	Length	Greater diameter	Lesser diameter
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Greatest.....	10. 0	15. 8	13. 8
Least.....	6. 7	9. 2	8. 0
Average.....	8. 5	13. 2	11. 3

The specimen figured is U.S.N.M. No. 356354.

One hundred specimens from the limestone hill bayward from the rifle range measure:

	Length	Greater diameter	Lesser diameter
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Greatest.....	9. 5	14. 8	13. 2
Least.....	7. 0	11. 2	9. 6
Average.....	8. 2	13. 0	11. 2

The specimen figured is U.S.N.M. No. 356356.

We have selected an average specimen from each of these localities for figuring.

The broader, less elevated, and more rounded axial ribs differentiate this subspecies from *Annularia* (*Annularisca*) *auricoma putre* ([Gundlach] Pfeiffer).

ANNULARIA (ANNULARISCA) AURICOMA PUTRE ([Gundlach] Pfeiffer)

PLATE 42, FIGURES 1-3

1863. *Choanopoma putre* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 10, p. 193.
 1920. *Tudora* (*Tudorellata*) *putre* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 76.

This subspecies comes from the mouth of Yateras River, some 13 miles east of the Naval Station in Guantánamo Bay. It is easily distinguished from *A. (A.) auricoma auricoma* by its greater elevation, more narrow umbilicus, and sharper axial ribs.

The specimen figured, U.S.N.M. No. 356358, is a cotype collected by Gundlach. It has 4 whorls and measures: Length, 9.2 mm.; greater diameter, 16.2 mm.; lesser diameter, 13.0 mm.

Gundlach says of the animal (Malakozool. Blätter, vol. 10, p. 193, 1863): "Animal gray with greenish suffusion; sides of foot marked by spots composed of white dots. Tentacles coral red becoming paler from the tip to the middle. The edge of the snout is of the same (coral red) color. The rest of the snout to the forehead is blackish. Forehead and the region about the eyes much paler than the body."

ANNULARIA (ANNULARISCA) PALLENS, new species

PLATE 43, FIGURES 4-6

Shell depressed-helicoid, straw yellow, with the peristome whitish and the interior of the aperture of the same color as the exterior. Nuclear whorls 1.5, smooth except for the last portion of the last turn, which shows the beginning of the postnuclear axial sculpture. Postnuclear whorls inflated, strongly rounded, marked by well-developed, very closely spaced, regular, retractively slanting axial riblets, which are separated by spaces about as wide as the riblets. Suture narrowly channeled. Periphery strongly rounded. Base short, strongly rounded, openly umbilicated, marked by the continuation of the axial sculpture. On the umbilical wall 11 spiral threads are present in addition to the axial riblets, which render the latter wavy and feebly nodulose. Aperture broadly oval; peristome double, the inner and outer coextensive and fused, narrowly reflected, differentiated only at the posterior angle, where the inner peristome is indicated as a slight shelf. Operculum typically annularid.

The type, U.S.N.M. No. 104552, is one of three collected by Gundlach, and it is labeled Guantánamo. It has 4.2 whorls and measures: Length, 8.3 mm.; greater diameter, 13.5 mm.; lesser diameter, 10.6 mm.

A series of 20 specimens, all from old collections, are in the United States National Museum.

This species differs from the others in being in every way less heavy, in having the ribs much narrower and more closely spaced, in being practically unicolor, and in having the inside of the aperture straw-colored instead of orange.

ANNULARIA (ANNULARISCA) ALATA (Pfeiffer)

PLATE 43, FIGURES 1-3

1851. *Cyclostoma alatum* PFEIFFER, Proc. Zool. Soc. London, p. 250.

1852. *Choanopoma? alatum* PFEIFFER, Catalogue of Phaneropneumona . . . in the British Museum, p. 117.

1852. *Choanopoma alatum* PFEIFFER, *Conspectus cyclostomaccorum*, p. 60.

1920. *Tudora (Tudorellata) alatum* HENDERSON and BARTSCH, *Proc. U. S. Nat. Mus.*, vol. 58, p. 76.

Shell depressed-helicoid, moderately elevated, of flesh-colored ground color on upper surface, marked by slender, short dashes, which have their long axis spirally arranged. These are present on both spire and base. The base is a little paler than the spire. Peristome white; interior of the aperture orange. Nuclear whorls 1.7, well rounded, microscopically granulose. Postnuclear whorls marked by retractively curved axial riblets, which are moderately well elevated, and which are narrower than the spaces that separate them; the spiral sculpture consists of obsolete threads, which are scarcely indicated. Suture moderately well impressed. Periphery well rounded. Base short, strongly rounded, marked by the continuation of the axial ribs and feebly indicated spiral threads. On the umbilical wall, however, the spiral threads, while slender, are much more pronounced and quite numerous. The umbilicus is open but narrower than that of *A. (A.) auricoma*. Aperture almost circular; peristome double, the inner and outer coextensive and fused except at the posterior angle, where the inner forms a slight shelf separating it from the outer. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 535643, is one of six from Imías. It has 4.6 whorls and measures: Length, 10.3 mm.; greater diameter, 16.7 mm.; lesser diameter, 12.7 mm. This is the largest of the six. We selected it because it most nearly approaches the measurements of the one described by Pfeiffer. The smallest specimen of the lot has 4.6 whorls and measures: Length, 9.2 mm.; greater diameter, 13.3 mm.; lesser diameter, 10.7 mm.

Pfeiffer, when he described this species, stated that it came from "S. Yago de Cuba," i. e., Santiago. In 1856 (*Malakozool. Blätter*, vol. 3, p. 124) he stated that "S. Yago de Cuba" was the locality designation in Cuming's collection. This is undoubtedly an error, since the group does not range west to this point. We are giving three views of Pfeiffer's type, for which we are indebted to the authorities of the British Museum; also similar figure of a specimen from Imías, which is about 33 miles east of Guantánamo, on the south coast of Oriente Province, which we believe identical. The region about Imías, therefore, is probably the type locality for *A. (A.) alata*.

ANNULARIA (ANNULARISCA) TACRENSIS, new species

PLATE 40, FIGURES 4-6

Shell small, depressed-helicoid, pale horn colored, with peristome white. Interior of the aperture brownish orange. Nuclear whorls 1.5, well rounded, microscopically granulose. Postnuclear whorls well

rounded, marked by retractively curved, slender, well elevated, narrow ribs. There is no indication of obsolete spiral threads on spire or base. Suture well constricted. Periphery inflated, strongly rounded. Base short, strongly rounded, narrowly, openly umbilicated, marked by the continuation of the axial ribs and on the parietal wall by feebly developed, slender spiral threads, which are rather few in number, and which are rather distantly spaced. Aperture circular; peristome double, the inner coextensive on the outer lip with the outer, separated from the outer on the inner lip and the parietal wall by an impressed line. On the inner lip and the parietal wall the outer peristome becomes flaringly expanded and attenuated and forms a conspicuous projection at the posterior angle. Operculum typically annularid.

The type, U.S.N.M. No. 535645, comes from Tacre, west of Cajobabo, Oriente Province. It has 4.2 whorls and measures: Length, 8.9 mm.; greater diameter, 11.0 mm.; lesser diameter, 8.4 mm.

The extremely small size and the sharp axial ribs will distinguish this species from all the others.

ANNULAREX, new subgenus

Shell as in *Annularella*, but with spiral sculpture on the spire.

Type: *Annularia* (*Annularex*) *intercisa*, new species.

KEY TO THE SPECIES OF THE SUBGENUS ANNULAREX

Spiral sculpture of spire strong.

Outer peristome of inner lip broadly expanded..... *intercisa*

Outer peristome of inner lip not broadly expanded..... *mackinlayi*

Spiral sculpture of spire not strong.

Spiral threads on umbilical wall strong..... *incerta*

Spiral threads on umbilical wall feeble..... *ramsdeni*

ANNULARIA (ANNULAREX) INTERCISA, new species

PLATE 44, FIGURES 1-3

Shell moderately large, depressed-helicoid, flesh colored with a brownish flush; peristome white, with the interior of the aperture pale orange. Nuclear whorls 1.5, small, well rounded, microscopically granulose. The postnuclear whorls are inflated and strongly rounded; the first turn has 75 very slender, retractively curved axial riblets, the same type of sculpture continuing for another fraction of a whorl; this sculpture is followed by a stage in which there is a differentiation between the stronger, distantly spaced axial ribs and the fine intercalated threads, the latter gaining rapidly in strength so that on the last half of the last turn it is difficult to distinguish them from the stronger. In addition to this, the whorls are marked by spiral threads, which are a little stronger than the axial ribs. These are not apparent on the first postnuclear whorl, but on the second 6 are present between

the summit and the suture, and 9 on the last. The spiral threads render the stronger axial riblets slightly nodulose and the finer wavy. Suture slightly channeled. Periphery of the last whorl well rounded. Base short, strongly rounded, marked by the continuation of the axial ribs and by 10 spiral threads, which are of almost equal strength. The umbilicus is broadly open and marked by the feeble continuation of the axial ribs and by 8 spiral threads, which become consecutively stronger and a little more distantly spaced from within toward the outside, the outermost being the strongest. Aperture almost circular; peristome double, the inner and outer being coextensive on the outer and basal lip and differentiated only by an impressed line on the inner lip and at the posterior angle. At the posterior angle the outer peristome forms an auricle. Operculum typically annularid.

The type, U.S.N.M. No. 535661, was collected by Dr. Ramsden at Ocuja, Vega Grande, Oriente Province. It has 4.5 whorls and measures: Length, 8.3 mm.; greater diameter, 12.7 mm.; lesser diameter, 9.5 mm.

ANNULARIA (ANNULAREX) MACKINLAYI ([Gundlach] Pfeiffer)

PLATE 41, FIGURES 4-6

1859. *Cyclostoma mackinlayi* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6, pp. 73-74.
1861. *Cistula mackinlayi* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.
1920. *Tudora (Tudorellata) mackinlayi* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell broadly turbinate, straw colored. Nuclear whorls and the peristome a little paler; interior of the aperture pale orange. Nuclear whorls 2, well rounded, microscopically granulose, except the last portion of the last turn, which shows the beginning of the postnuclear axial sculpture. Postnuclear whorls inflated, very broad, marked by retractively slanting, sublamellar axial riblets, between which finer axial threads are present; the coarser riblets are slightly expanded at their summit. Of the coarser riblets, 54 occur on the third, and 74 are on the last whorl. The finer riblets between the stronger lamellar ribs vary from 2 to 5 in number; in addition to the axial sculpture, the postnuclear whorls are marked by spiral threads, of which 6 occur on the third and 13 on the last whorl between summit and suture. The junctions of the spiral threads and the sublamellar axial riblets form feeble nodules, while the intercalated riblets are merely rendered somewhat wavy by the spiral threads. Suture channeled. Periphery well rounded. Base short, strongly rounded very openly umbilicated, marked by the continuation of the axial sculpture and 11 spiral threads, the latter a trifle weaker than those on the spire, but they also affect the axial riblets in the same manner as they do on the spire. The

umbilical wall is marked by the closely crowded axial riblets, which here are a trifle weaker, and by 10 spiral threads, of which the outermost is much stronger than those within, which are of equal strength and almost equal spacing. Aperture subcircular; peristome double, the two peristomes coextensive on the outer and basal lip, while on the inner lip the outer extends slightly beyond the inner; at the posterior angle the outer forms an auricle which is adnate to the preceding turn, while the inner projects as a strong shelf. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 356331, is a topotype collected by Gundlach at Cafetal Ermitano, Yateras, Oriente Province. It has 4.4 whorls and measures: Length, 8.8 mm.; greater diameter, 11.9 mm.; lesser diameter, 9.3 mm.

Gundlach states of the animal of this species (Malakozool. Blätter, vol. 6, p. 74, 1859): "On cliffs. Animal gray with whitish dots, especially so on the rosy colored head. Feelers from the middle to the base red but with brownish tip. Snout reddish, red at the edge and brown at the base."

ANNULARIA (ANNULAREX) INCERTA, new species

PLATE 45, FIGURES 1-3

Shell broadly turbinate, flesh colored, with whitish diaphanous spots that are arranged in spiral series; peristome white; interior of the aperture orange. Nuclear whorls 1.6, small, inflated, strongly rounded, forming a rather elevated spire. Postnuclear whorls inflated, strongly rounded, marked by very strong, almost lamellar axial ribs, of which 38 are present on the first postnuclear whorl. On the succeeding turn there is a differentiation into stronger ribs with finer threads between them. These, however, are few in number, varying from 1 to 3, which gain rapidly in strength so that on the last turn there is a complete confusion of strong and fine threads; sometimes 5, 6, or 8 of the finer threads may be present between the coarser ribs; again, they may be absent altogether, about 80 of the stronger threads being present on the last turn. The strong axial ribs form rather conspicuous auricles at the summit. The spiral sculpture consists of feeble threads which scarcely render the axial riblets weakly nodulose. Suture strongly, deeply channeled. Periphery well rounded. Base short, strongly rounded, openly umbilicated, and marked by the continuation of the axial ribs and weak indications of spiral threads. On the umbilical wall, however, the spiral sculpture becomes decidedly pronounced, 11 strong threads being present, of which the outermost one marks the edge of the umbilicus, which is much stronger than the rest. The junction of the axial ribs and spiral threads within the umbilicus forms sharp nodules. Aperture broadly oval; peristome

double, the inner and outer coextensive on the basal and anterior half of the outer lip, separated by an impressed groove on the inner lip and decidedly differentiated at the posterior angle, where the inner peristome forms a conspicuous shelf, while the outer forms a decided auricle which may bear a number of concentric lamellae. Both peristomes are moderately expanded and reflected and are of about the same width all around except at the parietal wall, where they are a little narrower. Operculum typically annularid.

The type, U.S.N.M. No. 535663, was collected by Dr. Ramsden at La Cobreira, east of Guantánamo. It has 5 whorls and measures: Length, 10.0 mm.; greater diameter, 11.0 mm.; lesser diameter, 8.0 mm.

ANNULARIA (ANNULAREX) RAMSDENI (Pilsbry and Henderson)

PLATE 45, FIGURES 4-6

1912. *Annularia ramsdeni* PILSBRY and HENDERSON, Nautilus, vol. 26, p. 42.

1913. *Annularia ramsdeni* PILSBRY and HENDERSON, Nautilus, vol. 27, p. 37, pl. 3, figs. 5, 6.

1920. *Tudora (Tudorellata) ramsdeni* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75, MS.?

Shell very broadly turbinate, straw colored. Nuclear whorls 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear axial riblets. Postnuclear whorls very broad, inflated, strongly rounded, marked by retractively slanting, sublamellar axial riblets, between which finer riblets occur; this is particularly true on the middle whorl. On the last turn the intercalated threads attain almost the size of the stronger. The stronger riblets become slightly expanded at the summit, particularly so on the middle whorl. There are 46 of the stronger axial riblets on the first postnuclear whorl, 62 on the second, while on the last they cannot be differentiated from the finer threads. The finer threads vary from 2 to 7. The spiral sculpture consists of feeble threads, which are too poorly defined on the first postnuclear whorl to be counted, 7 are present on the second, and 12 are on the last between the summit and suture. The junction of the stronger axial riblets and spiral threads forms very feeble nodules, while the finer threads are merely rendered slightly wavy. Suture very deeply channelled. Periphery well rounded. Base short, openly umbilicated, well rounded, marked by the continuation of the axial sculpture and by 10 spiral threads equalling those on the spire in strength. The umbilical wall is marked by the continuation of the axial riblets, which here are slightly diminished in strength and closely crowded; 13 spiral threads are present, of which the outermost is much stronger than the 12 within, which are of subequal strength and spacing. Aperture subcircular, very oblique; peristome double, the inner and outer

coextensive on the outer and basal lip; on the inner lip the outer projects slightly beyond the inner, while at the posterior angle it is developed into a very strong auricle, while the inner peristome here forms a conspicuous shelf. Operculum typically annularid.

A cotype, U.S.N.M. No. 356337, from El Jigüe de la Argolla, east of Guantánamo, Oriente Province, has 5 whorls and measures: Length, 10.5 mm.; greater diameter, 14.2 mm.; lesser diameter, 10.4 mm.

BERMUDEZIA, new subgenus

Shell of turbate outline, having both axial and spiral sculpture on the spire. The axial ribs are not of two strengths, but are of uniform development. Umbilicus open, forming a hollow axis. Peristome simple. Operculum provided with a strong calcified lamella, which is outward deflected to parallel the basal chondroid plate; the outer edge of the lamella does not extend to the outer limit of the whorls of the basal plate, but it leaves a rather broad zone of the chondroid base showing, as in typical *Annularia*. The lamella is marked by fine, retractively curved threads.

Type: *Annularia* (*Bermudezia*) *bermudezi*, new species.

KEY TO THE SPECIES OF THE SUBGENUS BERMUDEZIA

Spiral sculpture stronger than axial.

Axial sculpture feeble..... *bermudezi*

Axial sculpture not feeble..... *payroli*

Spiral sculpture not stronger than axial.

Spiral and axial sculpture both obsolete..... *obliterata*

Spiral and axial sculpture not obsolete.

Axial sculpture stronger than spiral.

Operculum with prominent lamella..... *capestanyi*

Operculum with obsolete lamella..... *euglypta*

ANNULARIA (BERMUDEZIA) *BERMUDEZI*, new species

PLATE 46, FIGURE 1

Shell of turbate outline, thin, varying from flesh to straw color in ground color, marked by interrupted spiral bands of brown, which are also arranged in axial series. The elements composing these bands are not uniform and they sometimes produce a slightly zigzag pattern. This color scheme extends over the spire and base and is present also on the umbilical wall. There is a dark sutural line in the nuclear whorls, while the interior of the aperture shows the external color scheme through the thin wall of the shell. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls well rounded, marked by feeble, retractively slanting, incremental lines and strong rounded spiral cords, which are about as wide as the spaces that separate them. Of these cords 4 occur on the first, 8 on the second, 12 on the third, and 16 on the last whorl between the summit and the periph-

ery. Suture well constricted. Periphery inflated, strongly rounded. Base short, openly umbilicated, well rounded, and marked by spiral cords like the spire but here the axial sculpture becomes intensified and forms slight fenestrations between the spiral cords. The umbilical wall is marked by slender axial riblets and by feebly expressed spiral threads. The last whorl is slightly solute. Aperture broadly oval; peristome simple, the lip slightly reflected. Operculum typically bermudezid. The lamella is marked by fine, retractively curved, incremental lines.

The type, U.S.N.M. No. 493492, was collected by Bermudez at Loma Murciélagos, Vega Alta, Santa Clara Province. It has 5.8 whorls and measures: Length, 15.2 mm.; greater diameter, 11.6 mm.; lesser diameter, 9.6 mm.

This species ranges through the lomas of the region about Vega Alta. In addition to the type locality we have it from Lomas Sinaloa, Vereda del Abra and El Mamey, Fincas El Mirador and San Miguel, Loma del Infierno, Cueva Galana, and Loma Sola.

Bartsch describes the animals of this species, collected by him at Loma Vereda del Abra on August 13, 1928, as having the dorsal part pale smoky gray, marked with many papillae, which are covered by numerous white dots. There is a pinkish area behind the tentacles on the dorsum. Tentacles flesh colored tipped with pale orange. Sides smoky with a pale olivaceous tinge, which is also the color of the deeply cleft sole of the foot. The shell is carried free, and the motion is direct.

ANNULARIA (BERMUDEZIA) PAYROLI, new species

PLATE 46, FIGURE 3

Shell of turbate outline, of pale yellowish ground color with interrupted spiral bands of brown. The dots composing these bands may be in axial series or they may be diversely scattered. The nuclear whorls are darker than the rest of the shell and they show the dark sutural line, the first postnuclear whorl being the darkest of all. There is a moderately broad band of brown slightly within the umbilicus. Nuclear whorls 1.5, small, inflated, well rounded, microscopically granulose. Postnuclear whorls inflated and marked by weak axial riblets, which are rather closely spaced, and by strong spiral cords. Of the latter, 4 are present on the first, 8 on the second, while on the third slender intercalated cords make their appearance, the combination totaling 16. On the last whorl 25 cords are present between summit and suture. Base short, inflated, strongly rounded, openly umbilicated, marked by 13 spiral cords which are of the same strength and spacing as those on the spire. Here, as well as on the spire of the last turn, the axial riblets, in combination with the spiral

cords, produce a fenestrated pattern. The edge of the umbilicus, which is practically the middle of the base, is marked by a strong cord. Between that and the inner umbilical wall there are 3 additional strong cords, with 5 between the first and the next strong cord, and a slender one between the other two. The umbilical wall itself shows 21 spiral cords and rather well elevated, slender, closely spaced, axial riblets. The last whorl is solute for about one-tenth of a turn. Aperture broadly oval; peristome simple. Operculum bermudezid.

The type, U.S.N.M. No. 493493, comes from Lomas del Purio, Calabazar, Santa Clara Province. It has 6 whorls and measures: Length, 16.2 mm.; greater diameter, 13.3 mm.; lesser diameter, 10.4 mm.

The species seems to be present on all the limestone blocks surrounding the Central Purio.

ANNULARIA (BERMUDEZIA) OBLITERATA, new species

PLATE 46, FIGURE 4

Shell of turbinate outline, rather large, very thin, translucent, straw colored, with interrupted spiral bands of brown; the irregular spots composing these bands are broad and irregularly spaced; they are arranged in both axial and spiral series. They are present on the spire, base, and umbilical wall. The nuclear whorls do not have a broad sutural band. Nuclear whorls 2, well rounded, microscopically granulose. The first 2 postnuclear whorls are marked by retractively slanting, slender, axial riblets while on the succeeding whorls these riblets become reduced, until on the last whorl only incremental lines are present. On the first postnuclear whorl there are indications of microscopic spiral striations, which also vanish as the shell increases in size. Suture well impressed. Periphery strongly rounded. Base moderately long, openly umbilicated, strongly rounded, and marked by the continuation of the lines of growth, and obsolete spiral threads and weak malleations. The umbilical wall is marked by fine, rather closely spaced, axial threads. The last whorl is slightly solute. Aperture broadly oval; peristome simple. Operculum typical bermudezid.

The type, U.S.N.M. No. 493494, which comes from Cerro de Guajabana, Santa Clara Province, has lost the nucleus. The 5 remaining whorls measure: Length, 19.2 mm.; greater diameter, 15.2 mm.; lesser diameter, 12.7 mm.

ANNULARIA (BERMUDEZIA) CAPESTANYI new species

PLATE 46, FIGURE 5

Shell of turbinate outline, thin, semitranslucent, pale straw colored, with interrupted spiral bands of chestnut brown, which are composed of rather elongated streaks, arranged in both axial and spiral series.

These bands are present on both spire and base. No dark sutural line is present on the nuclear whorls. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls marked by retractively slanting axial ribs, which are quite regular and about half as wide as the spaces that separate them. Spiral sculpture absent on the spire. Suture well impressed. Periphery strongly rounded. Base short, moderately, openly umbilicated, marked by the continuation of the axial ribs, and on the umbilical wall by feebly developed spiral threads. The last whorl is very slightly solute. Aperture broadly oval; peristome simple. Operculum typically bermudezid.

The type, U.S.N.M. No. 493495, comes from Palenque de Taguayabón, near Remedios, Santa Clara Province. It has 6 whorls and measures: Length, 18.1 mm.; greater diameter, 13.4 mm.; lesser diameter, 11.2 mm.

ANNULARIA (BERMUDEZIA) EUGLYPTA, new species

PLATE 46, FIGURE 6

Shell of turbinate outline, thin, pale yellow, with interrupted spiral bands of dark chestnut-brown. The spots composing these bands are round and distantly spaced, and they are present on both spire and base. On the umbilical wall there are almost continuous lines of brown. The nuclear whorls do not show a brown sutural line. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, marked by decidedly retractively slanting, quite well elevated axial ribs, which are about half as wide as the spaces that separate them. Suture well constricted. Periphery well rounded. Base moderately broadly openly umbilicated, marked by the continuation of the axial ribs. The umbilical wall, in addition to the axial ribs, shows feeble spiral threads. The last whorl is slightly solute. Aperture very broadly oval, almost subcircular; peristome simple. Operculum typically bermudezid.

The type, U.S.N.M. No. 493496, has 6 whorls and measures: Length, 17.9 mm.; greater diameter, 13.9 mm.; lesser diameter, 11.2 mm. This species comes from Loma Platero, which is a little east of Jagüeyar, Santa Clara Province.

The animals of this species were described by Bartsch from material collected at Loma Platero August 10, 1928. The upper side pinkish buff in general tone, with a sooty smudge between the tentacles, this smudge extending forward toward the snout. The posterior portion of dorsum pale olivaceous; base of tentacles of the same color as the body, the rest black, except the extreme attenuated tip, which is grayish flesh colored. Sides of the body a little paler than the back, covered by numerous fine whitish tubercles. Sole of the foot pale buff, deeply cleft medially. The animal when at rest suspends itself by a mucous thread.

LUGARENIA, new subgenus

Shell varying from broadly elongate-conic to turbate in outline. Axial ribs present on spire and base. The spiral sculpture may be confined to the umbilicus or it may extend over the entire shell. Base openly umbilicated. Peristome double. Operculum with a broadly expanded lamella, which is reflected outward to parallel the chondroid plate, not marked by fine, retractorily curved threads; the lamellae of succeeding turns do not extend to the edge of the turns, but they leave a band of the basal plate exposed.

Type: *Annularia* (*Lugarenia*) *najazaensis*, new species.

KEY TO THE SPECIES OF THE SUBGENUS LUGARENIA

Junctions of axial ribs and spiral threads strongly nodulose.....	eurystoma
Junctions of axial ribs and spiral threads weakly nodulose.	
Nodules obsolete on last whorl.	
Shell turbate.....	biayensis
Shell elongate-ovate.....	najazaensis
Nodules not obsolete on last whorl.	
Last whorl adnate.....	lirata
Last whorl solute.....	sifontesi

ANNULARIA (LUGARENIA) EURYSTOMA, new species

Shell turbate, pale yellow, with interrupted spiral bands of brown on spire and base. The elements composing these bands are also arranged in axial series. There is a dark sutural band on the nuclear turns. Nuclear whorls 2, small, well rounded, microscopically granulose. Postnuclear whorls decidedly inflated, strongly rounded, marked by slender, retractorily curved axial threads, which are about one-fourth as wide as the spaces that separate them, and by spiral threads a little stronger than the axial, which render the axial riblets granulose at their junctions. At the summit of the whorl the axial riblets project slightly into the suture and appear finely spinulose. Suture narrowly channeled. Periphery inflated, well rounded. Base short, well rounded, openly umbilicated, and marked by the continuation of the axial riblets and spiral threads, the junctions of which likewise form granulations. On the umbilical wall the spiral threads become emphasized and the axial riblets reduced, but here also the junction forms slender nodulations, the long axis of which coincides with the axial sculpture. Aperture broadly oval; peristome double, the inner either moderately exerted or reflected and appressed to the outer. Operculum typically lugarenid.

This species comes from southern Camagüey Province. We are recognizing two subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (LUGARENIA) EURYSTOMA

Posterior half of inner lip broadly expanded..... *eurystoma*
 Posterior half of inner lip not broadly expanded..... *chorrillensis*

ANNULARIA (LUGARENIA) EURYSTOMA EURYSTOMA, new subspecies

PLATE 47, FIGURE 6

This subspecies comes from the Sierra del Cachimbo, which lies between the Sierra del Chorrillo and Sierra de Najaza, in Camagüey Province.

It is easily differentiated from *A. (L.) eurystoma chorrillensis* by having the posterior portion of the outer lip of the outer peristome broadly expanded. It is also much larger.

The type, U.S.N.M. No. 493497, has 5.4 whorls and measures: Length, 13.5 mm.; greater diameter, 12.3 mm.; lesser diameter, 9.6 mm.

ANNULARIA (LUGARENIA) EURYSTOMA CHORRILLENSIS, new subspecies

PLATE 47, FIGURE 2

This subspecies comes from the Vereda del Telegrafo, which crosses the Sierra del Chorrillo.

It is easily distinguished from *A. (L.) eurystoma eurystoma* by being smaller and by having the posterior half of the inner lip not broadly expanded. It also has the inner peristome much more exerted, forming a shelf at the posterior angle, at which the outer peristome is slightly auriculate.

The type, U.S.N.M. No. 493499, has 5.4 whorls and measures: Length, 10.8 mm.; greater diameter, 9.7 mm.; lesser diameter, 7.7 mm.

ANNULARIA (LUGARENIA) BIAYENSIS, new species

PLATE 47, FIGURE 3

Shell of turbinate outline, thin, pale yellow, with slender interrupted spiral bands of brown, of which 3 are present on the spire and 3 are on the base. There is also a dark spot in the suture of the nuclear tip. Nuclear whorls very strongly inflated, rounded, microscopically granulose. Postnuclear whorls strongly rounded, marked by decidedly retractively curved axial ribs, which are crenulated at the summit. In addition to the crenulations there is a second row of nodules a little anterior to the summit. The axial ribs are slender, narrow, and well elevated, and about one-fifth as wide as the spaces that separate them. Suture channeled. Periphery well rounded. Base moderately long, well rounded, openly umbilicated, marked like the spire on the posterior two-thirds. On the anterior third 4 strong spiral threads are present, of which the fourth marks the edge of the

umbilicus, and is heavier than the rest. On the umbilical wall 10 additional spiral cords are present, which render the axial riblets slightly scalloped. Last whorl solute for about one-tenth of a turn. Aperture broadly ovate; peristome double, the inner moderately expanded and reflected, forming a little shelf at the posterior angle; the outer very broadly expanded, somewhat hooded at the posterior angle and fluted on the broad inner lip. Operculum typically lugarenid.

The type, U.S.N.M. No. 493501, was collected by Rodriguez in the Sierra de San Martin de Biaya, Camagüey Province. It has 5.5 whorls and measures: Length, 12.3 mm.; greater diameter, 10.0 mm.; lesser diameter, 8.1 mm.

ANNULARIA (LUGARENIA) NAJAZAENSIS, new species

Shell broadly elongate-ovate, pale yellow, with or without obsolete interrupted spiral bands of brown. Nuclear whorls very strongly inflated, well rounded, minutely granulose, forming a somewhat pupoid apex. Postnuclear whorls inflated, strongly rounded, appressed at the summit, marked by sublamellar, retractively slanting axial ribs, which are quite variable in strength. The spiral sculpture is very feebly expressed, being indicated only by minute nodulations on the ribs, and these are best developed near the summit of the shell. Suture strongly constricted. Periphery inflated, well rounded. Base moderately long, well rounded, openly umbilicated, marked by the continuation of the axial ribs and spiral threads. Aperture ovate; peristome double, the inner exerted and reflected, forming a slight shelf at the posterior angle; the outer rather broadly expanded and slightly hooded at the posterior angle. Operculum typically lugarenid.

This species also comes from the southern part of Camagüey Province.

We are recognizing two subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (LUGARENIA) NAJAZAENSIS

Spiral sculpture of umbilical wall strong-----	najazaensis
Spiral sculpture of umbilical wall feeble-----	palomarensis

ANNULARIA (LUGARENIA) NAJAZAENSIS NAJAZAENSIS, new subspecies

PLATE 47, FIGURE 7

This subspecies is easily distinguished from *A. (L.) najazaensis palomarensis* by its larger size and stronger sculpture of the umbilical wall. It also has the nodules on the spire less strongly emphasized.

The type, U.S.N.M. No. 493503, was collected by Dr. de la Torre at El Cacaotal, Sierra de Najaza, Camagüey Province. It has 6.2 whorls and measures: Length, 15.1 mm.; greater diameter, 10.3 mm.; lesser diameter, 8.4 mm.

ANNULARIA (LUGARENIA) NAJAZAENSIS PALOMARENSIS, new subspecies

PLATE 47, FIGURE 8

This subspecies comes from Palomar de San José, Camagüey Province. It is easily distinguished from *A. (L.) najazaensis najazaensis* by its smaller size, by its little more slender form, and by having the nodulations near the summit of the whorls more pronounced and the spiral sculpture less strongly developed.

The type, U.S.N.M. No. 493505, has 6.1 whorls and measures: Length, 13.1 mm.; greater diameter, 9.5 mm.; lesser diameter, 7.0 mm.

ANNULARIA (LUGARENIA) LIRATA, new species

Shell of elongate-turbinate outline, pale yellow, with feebly expressed interrupted spiral bands of brown, of which the one a little below the periphery seems most pronounced. There is also a dark spot in the suture of the nucleus. Nuclear whorls 2, well rounded, smooth, forming a somewhat depressed apex. Postnuclear whorls inflated, strongly rounded, marked by retractively curved, sublamellar axial riblets, which are rendered nodulose by spiral threads. The nodulation varies in strength in the different subspecies. Suture very strongly constricted. Periphery inflated, well rounded. Base short, openly umbilicated, marked by the continuation of the axial ribs and by spiral threads which here become a little stronger than they are on the spire. On the umbilical wall the spiral threads increase in number but are reduced in strength. The last whorl is adnate. Aperture broadly ovate; peristome double, the inner reflected and more or less adnate to the outer; the outer rather broadly expanded, somewhat fluted, and marked by concentric lines of growth. Operculum typically lugarenid.

This species comes from the Sierra de Guaicanamar.

We are recognizing two subspecies, which the following key will help to differentiate:

KEY TO THE SUBSPECIES OF ANNULARIA (LUGARENIA) LIRATA

Nodulation on the last whorl strong-----	<i>lirata</i>
Nodulation on the last whorl feeble-----	<i>parva</i>

ANNULARIA (LUGARENIA) LIRATA LIRATA, new subspecies

PLATE 47, FIGURE 1

This subspecies was collected by P. Sifontes at Guaicanamar, Camagüey Province. It can easily be distinguished from *A. (L.) lirata parva* by its larger size and much stronger nodulation.

The type, U.S.N.M. No. 493507, has 6.0 whorls and measures: Length, 13.0 mm.; greater diameter, 9.8 mm.; lesser diameter, 7.8 mm.

ANNULARIA (LUGARENIA) LIRATA PARVA, new subspecies

PLATE 47, FIGURE 5

This subspecies comes from La Caridad de Guerrero, Sierra de Guaicanamar.

It is readily distinguished from *A. (L.) lirata lirata* by its smaller size and by its less strongly developed nodulation and spiral sculpture in the umbilicus.

The type, U.S.N.M. No. 493509, has 5.7 whorls and measures: Length, 11.2 mm.; greater diameter, 8.3 mm.; lesser diameter, 6.8 mm.

ANNULARIA (LUGARENIA) SIFONTESI, new species

PLATE 47, FIGURE 4

Shell turbate, pale yellow, with or without a dark band immediately below the summit. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, appressed at the summit, and marked by retractorily curved, almost lamellar axial riblets, which are rather distantly spaced. These riblets are rendered feebly nodulose by obsolete spiral threads. Suture strongly constricted. Periphery inflated, strongly rounded. Base moderately long, very broadly, openly umbilicated, marked by the continuation of the axial ribs and near the umbilicus by 3 spiral threads. Within the umbilicus 14 spiral threads are present which render the axial ribs finely nodulose. The last whorl is solute for about one-tenth of a turn. Aperture broadly oval; peristome double, the inner reflected and appressed to the outer; the outer moderately, broadly expanded, forming somewhat of a hood at the posterior angle. Operculum typically lugarenid.

The type, U.S.N.M. No. 493511, was collected by Pablo Sifontes, for whom it is named, in the Sierra del Cachimbo between Sierra de Najaza and El Chorrillo. It has 5.5 whorls and measures: Length, 10.9 mm.; greater diameter, 8.9 mm.; lesser diameter, 7.5 mm.

Subgenus ANNULAROSA Henderson and Bartsch

1920. *Annularosa* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 72.

Shell turbate, umbilicated. The early postnuclear whorls with faint axial riblets, which become obsolete on the last turn. Base malleated, the main axis of the malleations being placed in such a regular manner as to suggest spiral threads. A strong spiral keel marks the boundary between the umbilical wall and the base. The umbilical wall is marked by a few spiral threads. Operculum typically annularid.

Type: *Annularia (Annularosa) fragilis* ([Gundlach] Pfeiffer).

ANNULARIA (ANNULAROSA) FRAGILIS ([Gundlach] Pfeiffer)

Shell broadly conic, pale horn colored. Nuclear whorls almost 2, well rounded, microscopically granulose, scarcely differentiated from the postnuclear turns. Postnuclear whorls strongly rounded and marked by almost obsolete, slightly retractively curved axial riblets. Suture strongly impressed. Periphery well rounded. Base rather broadly, openly umbilicated, marked by the faint continuation of the axial riblets and by malleations, the latter placed in such a regular manner that they suggest spiral threads. The junction of the umbilical with the basal wall is marked by a rather strong spiral cord. The umbilical wall shows faint spiral threads. Last whorl solute for a fraction of a turn. Aperture subcircular; peristome simple. Operculum typically annularid.

The following key and descriptions will differentiate the subspecies:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULAROSA) FRAGILIS

Spiral threads on umbilical wall obsolete.....	<i>fragilis</i>
Spiral threads on umbilical wall not obsolete.....	<i>juliani</i>

ANNULARIA (ANNULAROSA) FRAGILIS FRAGILIS ([Gundlach] Pfeiffer)

PLATE 48, FIGURES 1-3

1859. *Choanopoma fragile* [Gundlach] PFEIFFER, Malakozool. Blatter, vol. 6, p. 70.
 1862. *Cyclostoma fragile* REEVE, Conchologia iconica, No. 153.
 1920. *Annularia (Annularosa) fragilis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 72.

This, the typical subspecies, was collected by Gundlach on Monte Toro, at Cafetal Yemen, northeast of Guantánamo, Oriente Province.

The specimen described and figured, U.S.N.M. No. 355900, a cotype, was received by Dr. de la Torre from Gundlach. It has 5 whorls and measures: Length, 10.6 mm.; greater diameter, 10.5 mm.; lesser diameter, 8.2 mm.

Typical *A. (A.) fragilis fragilis* is readily distinguished from *A. (A.) fragilis juliani* in being larger, and in having the axial riblets merely indicated and more distantly spaced. The malleations of the base referred to in our description of the species are also much more pronounced, and the spiral threads on the umbilical wall are scarcely indicated.

We have also seen specimens collected by Wright at Rio Cuzco, Oriente Province.

ANNULARIA (ANNULAROSA) FRAGILIS JULIANI, new subspecies

PLATE 48, FIGURES 4-6

This subspecies was collected by Julian Acuña at Jarahueca, Alto Songo, Oriente Province. It is distinguished from the typical *A.*

(A.) *fragilis fragilis* in being smaller, in having the axial riblets a little more pronounced and the base less strongly malleated, and in having the umbilical wall marked by quite apparent spiral threads.

The type, U.S.N.M. No. 535603, has 4.5 whorls and measures: Length, 8.2 mm.; greater diameter, 10.3 mm.; lesser diameter, 6.5 mm.

Subgenus ANNULARELLA Henderson and Bartsch

1920. *Annularella* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

1920. *Tudorellata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell helicoid. The axial sculpture consists of strong ribs, between which finer axial threads are present. The spiral sculpture is confined to the umbilicus. Operculum typically annularid.

Type: *Annularia* (*Annularella*) *yunquensis* (Pfeiffer).

The great amount of material now available for study makes it necessary to combine the subgenus *Tudorellata* with *Annularella*.

KEY TO THE SPECIES OF THE SUBGENUS ANNULARELLA

Last whorl adnate.

Inner lip broad.

Interstitial axial riblets almost as strong as the heavier ribs.

Shell conic.

Umbilicus broad..... *hendersoni*

Umbilicus narrow..... *römeri*

Shell subglobular..... *cumulata*

Interstitial axial riblets finer than the heavier axial ribs.

Shell broadly openly umbilicated.

Shell red..... *victoris*

Shell not red.

Shell depressed-helicoid..... *yaterasensis*

Shell conic..... *heyneimanni*

Shell narrowly openly umbilicated..... *arquesi*

Inner lip not broad.

Spiral threads in umbilicus many..... *pseudalata*

Spiral threads in umbilicus few.

Shell broadly openly umbilicated..... *holguinensis*

Shell narrowly openly umbilicated..... *yumuriensis*

Last whorl solute.

Inner lip broad.

Fine axial riblets many..... *nipensis*

Fine axial riblets few.

Spiral threads on umbilical wall few..... *tanamensis*

Spiral threads on umbilical wall many..... *libanoensis*

Inner lip not broad.

Spiral threads on umbilical wall absent.

Interstitial axial riblets fine..... *natensoni*

Interstitial axial riblets strong..... *interstitialis*

Spiral threads on umbilical wall present.

Interstitial axial threads few and strong----- **toroensis**

Interstitial axial threads many and fine.

Auricle at posterior angle of aperture very strong- **mayensis**

Auricle at posterior angle of aperture not very strong.

Spiral threads on umbilical wall few.

Spiral threads on base present----- **yunquensis**

Spiral threads on base absent----- **wrighti**

Spiral threads on umbilical wall not few-- **mayariensis**

ANNULARIA (ANNULARELLA) HENDERSONI, new species

PLATE 49, FIGURES 1-3

?1878. *Cistula interstitiale* ARANGO, Contribucion a la fauna malacologica Cubana p. 22 in part.

?1880. *Cistula interstitiale* KOBELT, Jahrb. Deutsch. Malak. Ges., vol. 7, p. 266.

?1890. *Cistula interstitiale* CROSSE, Journ. Conchyl., vol. 38, p. 286, in part.

Shell conic, straw colored. Nuclear whorls 2, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, slender axial riblets, of which 44 occur on the first; on the second, intercalated riblets make their appearance which raise the number to 98; on the last whorl the intercalated riblets become as strong as the primary ones, and here they become conspicuously expanded into slender cusps at the summit. On the last turn, 194 of these are present. Suture strongly channeled. Periphery strongly rounded. Base short, inflated, strongly rounded, broadly, openly umbilicated, marked by the continuation of the axial ribs and by a strong spiral cord at its anterior margin. The umbilical wall is also marked by the continuation of the axial ribs, but here the riblets become much enfeebled. Seven spiral threads are also present on the umbilical wall. Last whorl adnate. Aperture broadly oval; peristome double, the inner slightly exserted, decidedly reflected on the outer lip, where it is appressed to and co-extensive with the outer lip; the outer is rather broadly expanded, forming a conspicuous auricle at the posterior angle, which is adnate to the preceding turn; on the inner lip the two peristomes are quite distinct. Operculum typically annularid.

The type, U.S.N.M. No. 356290, was collected by Henderson and Bartsch at the foot of Monte Libano, near Guantánamo, Oriente Province. It has 4.8 whorls and measures: Length, 9.8 mm.; greater diameter, 10.4 mm.; lesser diameter, 7.7 mm.

ANNULARIA (ANNULARELLA) RÖMERI (Pfeiffer)

PLATE 49, FIGURES 4-6

1864. *Cyclostomus römeri* PFEIFFER, Malakozool. Blätter, vol. 11, p. 105.

1866. *Cyclostomus römeri* PFEIFFER, Mon. Conch., vol. 2, pp. 277-278, pl. 68, figs. 10-11.

1890. *Colobostylus roemeri* CROSSE, Journ. de Conchyl., vol. 38, p. 302, in part.

1920. *Tudora (Tudorellata) roemeri* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell very broadly elongate-conic, almost turbinate, straw colored, with a watered-silk effect; the early whorls are usually darker than the rest; the peristome is yellowish white; the interior of the aperture is pale orange. Nuclear whorls 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, the first marked by retractively curved axial threads; on the second and the remaining turns these axial threads become accentuated into sublamellar threads, and between them finer, irregularly developed threads are present. The stronger axial ribs are slightly expanded at the summit and are adnate to the preceding turn. It is this arrangement which gives to the shell a regularly conic aspect. Suture not channeled. Periphery obsoletely angulated. Base short, well rounded, openly umbilicated, and marked by the continuation of the axial sculpture. A strong spiral cord marks the junction of the base and the umbilicus, and another a little weaker is immediately anterior to it, while on the umbilical wall fine obsolete spiral threads are present as well as the somewhat enfeebled continuation of the axial sculpture. Aperture oval; peristome obsoletely double, the inner forming somewhat of a ridge at the posterior angle and on the inner lip, and melting into the outer on the outer lip; the outer broadly, flaringly expanded, of about the same width all around and adnate to the preceding turn on the parietal wall. Operculum typically annularid.

U.S.N.M. No. 356282 was collected by Jeanneret at Salto del Indio, between Rio Yumuri and Punta de Maisi, Oriente Province. It has 4 whorls remaining, having lost a fraction of the first turn, and measures: Length, 10.5 mm.; greater diameter, 9.7 mm.; lesser diameter, 7.6 mm.

Gundlach says of the animal (published by Pfeiffer, loc. cit): "Animal pale with white dots gathered in spots on the foot. Head white from the base of the tentacles to the neck. Forehead with a dark transverse streak. Feelers cinnabar red with dark apex."

ANNULARIA (ANNULARELLA) CUMULATA (Pfeiffer)

PLATE 49, FIGURES 7-9

1863. *Cistula cumulata* PFEIFFER, Malakozool. Blätter, vol. 10, pp. 194-195.

1920. *Tudora (Tudorellata) cumulata* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 76.

Shell turbinate, varying in color from pale yellow to orange, with the peristome a little paler than the rest. Nuclear whorls 2, well rounded, microscopically granulose, with the last portion of the last turn showing the beginning of the postnuclear sculpture. Post-nuclear whorls inflated, strongly rounded, marked by retractively slanting, sublamellar axial riblets, of which 50 occur on the first, 70 on the second, and 82 on the last in the specimen figured. These riblets form low, flattened cusps at the summit. On the last whorl 1, 2, or 3 intercalated riblets may be present between the coarser ones, which are less than half the strength of the heavier ribs. Suture strongly channeled. Periphery well rounded. Base short, openly umbilicated, well rounded, marked by the continuation of the axial riblets and by a poorly defined spiral cord a little posterior to the umbilical angle. The axial riblets continue into the umbilicus, where they become somewhat enfeebled and closely crowded. Here too 7 rather strong spiral cords are present, of which the one forming the outer margin of the umbilicus is the strongest. Aperture broadly oval; peristome double, the outer flaringly expanded, adnate to the preceding turn at the parietal wall; the inner also broadly expanded and appressed to the outer, being differentiated from it at the posterior angle and on the inner lip. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 11051, is one collected by C. Wright at Baracoa, Oriente Province, the type locality. It has 4.2 whorls and measures: Length, 8.2 mm.; greater diameter, 9.3 mm.; lesser diameter, 7.5 mm.

ANNULARIA (ANNULARELLA) VICTORIS, new species

PLATE 50, FIGURES 7-9

Shell rather large, broadly turbinate, orange-red except for the peristome, which is paler; the interior of the aperture is brilliant orange immediately within the peristome, gradually becoming paler inward, the tip being the most brilliant. Nuclear whorls 2, well rounded, microscopically granulose, conforming with the outline of the spire. Postnuclear whorls moderately strongly rounded, marked by decidedly lamellose axial ribs, between which finer spiral threads varying from 3 to 8 in number are present. These finer threads are also slightly variable in size. On the first whorl the finer ribs are not apparent, 41 of the heavier being present. The second whorl has 50

and the last 43 of the strong ribs. The strong ribs terminate in fairly strong cusps at the summit, while the intercalated ribs form feeble nodules. Suture fairly strongly channeled. Periphery of the last whorl well rounded. Base short, well rounded, marked by the continuation of the axial ribs and by 4 slender spiral threads near the umbilicus, which are weaker than the heavier thread marking the outer limit of the umbilicus. The umbilicus is open and its wall is marked by 11 rather strong spiral cords, which render the axial riblets nodulose. The last whorl is adnate. Aperture pear-shaped, narrowest at the posterior angle. Peristome double, the outer and inner expanded all around and adnate to each other, separated only at the posterior angle, where the inner forms a sharp shelf above which the outer projects as a hood. Operculum typically annularid, but with the lamella flattened to parallel the chondroid plate on the last whorl. It has, however, the separating channel between the whorls that is characteristic of the group.

The type, U.S.N.M. No. 535654, was collected by Victor Rodriguez at Zona de Caleta, Maisi, Oriente Province. It has 4.9 whorls and measures: Length, 11.8 mm.; greater diameter, 13.3 mm.; lesser diameter, 9.8 mm. We take pleasure in naming this species for Dr. Rodriguez.

ANNULARIA (ANNULARELLA) YATERASENSIS (Pfeiffer)

PLATE 50, FIGURES 4-6

1865. *Choanopoma yaterasense* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, pp. 107-108.
1867. *Cyclostoma yaterasense* ARANGO, Report fisico natural Isla de Cubana, vol. 2, p. 77.
1920. *Tudora (Tudorellata) yateracensis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell depressed-helicoid, almost helicoid, flesh colored; the interior of the aperture with a yellowish tinge. Nuclear whorls 2, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by strong sublamellar, retractively slanting axial ribs, between which finer threads are present. The stronger ribs are expanded into slight auricles at the summit. Of the stronger of these ribs 48 occur upon the second, and 42 upon the last. Of the finer threads 2 to 5 occur between the stronger. In addition to the axial riblets, the whorls show mere indications of spiral threads, which render the axial riblets slightly wavy but which do not form cusps or tubercles. Suture strongly channeled. Periphery well rounded. Base short, well rounded, openly umbilicated, marked by the continuation of the axial ribs. On the umbilical wall 7 spiral threads are present; these are very feeble except for the outermost one, which is quite cordlike. Aperture subcircular; peristome double,

the outer slightly expanded, broadest on the inner lip, forming a conspicuous auricle at the posterior angle; the inner reflected and adnate to the outer at the middle of the outer wall, falling a little short of being coextensive with the outer on the basal wall, and only about half as wide on the inner lip and forming an inconspicuous curved shelf at the posterior angle. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 356340, a cotype, is one of 6 collected by Gundlach at Yateras, northeast of Guantánamo, Oriente Province, the type locality. It has 4.0 whorls and measures: Length, 8.0 mm.; greater diameter, 9.2 mm.; lesser diameter, 7.0 mm.

This species varies considerably in size, a large specimen having 4.5 whorls measures: Length, 10.2 mm.; greater diameter, 12.7 mm.; lesser diameter, 9.5 mm.

ANNULARIA (ANNULARELLA) HEYNEMANNI (Pfeiffer)

PLATE 50, FIGURES 1-3

1864. *Cyclostomus heyneimanni* PFEIFFER, Malakozool. Blätter, vol. 11, p. 105.

1867. *Cyclostoma heyneimanni* ARANGO, Repert físico natural Isla de Cubana, vol. 2, p. 75.

1890. *Colobostylus heyneimanni* CROSSE, Journ. Conchyl., vol. 38, p. 302 in part.

1920. *Tudora (Tudorellata) heyneimanni* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell conic, pale straw colored; peristome white; interior of aperture yellowish white. Nuclear whorls almost 2, well rounded, microscopically granulose, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls very strongly inflated, the first one marked by 72 rather distantly spaced, decidedly retractorily slanting axial riblets; on the second whorl intercalated finer threads make their appearance between the stronger riblets. This type of sculpture attains its maximum development on the last turn; the second has 120 of the stronger riblets, and the last 92. On this the finer riblets between the stronger threads vary from 2 to 9 in number; the stronger riblets are slightly expanded into auricles at the summit. Suture narrowly and weakly channeled. Periphery of the last whorl well rounded. Base short, openly umbilicated, well rounded, marked by the continuation of the axial sculpture and by a rather strong spiral cord posterior to the junction of the basal wall with the umbilicus; the latter place is marked by a strong spiral cord; within the umbilicus 7 additional, rather strong, spiral threads and the closely approximated, somewhat enfeebled continuation of the axial riblets are present. Aperture broadly oval; peristome double, the inner and outer both expanded and reflected and almost coextensive. The operculum is annularid but it has the lamella quite flattened, with a space separating the succeeding turns.

The specimen described and figured, U.S.N.M. No. 356296, is a cotype received from Dr. de la Torre and collected by Arango at Maisi, Oriente Province. It has 4.4 whorls and measures: Length, 7.8 mm.; greater diameter, 10.6 mm.; lesser diameter, 8.7 mm.

A larger specimen from the same locality, U.S.N.M. No. 356297, has 4.8 whorls and measures: Length, 9.7 mm.; greater diameter, 11.8 mm.; lesser diameter, 8.9 mm.

ANNULARIA (ANNULARELLA) ARQUESI, new species

PLATE 51, FIGURES 4-6

1866. *Cyclostomus römeri* var. PFEIFFER, Malakozool. Blätter, vol. 13, p. 63.
1867. *Cyclostoma arquesi* ARANGO, *nomen nudum*, MS., Repert físico natural Isla de Cubana, vol. 2, p. 270.
1876. *Cyclostomus römeri* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 3, p. 176, in part.
1898. *Colobostylus arquesi* KOBELT and MOLLENDORFF, *nomen nudum*, Nachr. Deutsch. Malak. Gesell., vol. 30, p. 192, in part.

Shell turbate, pale straw colored, a little deeper within the aperture. Nuclear whorls almost 2, well rounded, microscopically granulose except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, well rounded, the first one marked by 84 slender, threadlike axial ribs. On the remaining turns the axial sculpture becomes separated into two elements; one, strong lamellar axial ribs, which are developed into slender auricles at the summit; the other, fine threads less than one-fourth the size of the coarser, occupying the spaces between the coarser. The latter vary from 3 to 7 in number. Of the stronger ribs, 46 occur on the second turn and 50 on the last. Suture narrowly channeled. Periphery inflated, obscurely angulated. Base short, openly umbilicated, moderately well rounded, marked by the continuation of the axial riblets and by a strong spiral cord, which marks the junction of the umbilicus and the base. There are two slender spiral threads posterior to the stronger cord on the base. The umbilical wall is marked by the continuation of the axial riblets, which here become crowded and somewhat enfeebled, and 4 spiral threads. Aperture broadly oval; peristome double, the inner poorly defined, reflected over the outer and appressed to and coextensive with it on the outer lip; the outer broadly, flaringly expanded, forming a moderately strong auricle at the posterior angle, and adnate to the preceding turn on the parietal wall. Operculum typically annularid.

A cotype received from Dr. de la Torre, collected by Arango at Barigua, north coast of Baracoa, Oriente Province, U.S.N.M. No. 356294, has 5.3 whorls and measures: Length, 13.0 mm.; greater diameter, 12.1 mm.; lesser diameter, 9.7 mm.

This species was listed by Arango as cited above, with the statement that it would be published soon by Pfeiffer. Pfeiffer states under *Cyclostomus römeri* that the specimens sent him by Arango from Barigua are scarcely varietally distinguishable from typical *C. römeri*. We disagree with this statement. We consider it a valid species, which we describe.

ANNULARIA (ANNULARELLA) PSEUDALATA (Torre) Pilsbry and Henderson

PLATE 51, FIGURES 1-3

1865. *Cistula alatum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 110, in part.
1912. *Annularia pseudolatum* (Torre) PILSBRY and HENDERSON, Nautilus, vol. 26, pp. 43-44.
1913. *Annularia pseudolatum* TORRE, Nautilus, vol. 27, p. 37, pl. 3, figs. 8, 9.
1920. *Annularia* (*Annularella*) *pseudolatum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

Shell helicoid, flesh colored, with a yellowish tinge. Nuclear whorls almost 2, well rounded, smooth. Postnuclear whorls increasing very rapidly in size, inflated, strongly rounded, marked on the first turn by 22 slender, retractively curved, axial riblets; on the remaining turns the axial ribs become differentiated into two types, namely, strong sublamellar elements between which finer threads varying from 2 to 5 in number are present; of the stronger riblets, 72 are present on the second, with 99 upon the last turn. Suture strongly constricted. Periphery inflated, well rounded. Base short, inflated, strongly rounded, very openly umbilicated, the umbilicus being almost funnellike, marked by the continuation of the axial riblets, which extend into the umbilicus, and 3 spiral threads near the umbilicus, of which the one marking the junction of the umbilicus and the base is the strongest. On the umbilical wall 14 additional spiral threads, which are of almost the same strength, are present. Aperture broadly ovate; peristome double, the inner coextensive with the outer except at the auricle, where the two become differentiated; the outer moderately broadly expanded; the auricle at the posterior angle is adnate to the preceding turn. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 11052, was collected by C. Wright between Demajagua and Guantánamo, Oriente Province. It has 4.6 whorls and measures: Length, 11.2 mm.; greater diameter, 14.9 mm.; lesser diameter, 11.4 mm.

ANNULARIA (ANNULARELLA) HOLGUINENSIS, new species

PLATE 52, FIGURES 1-3

1865. *Choanopoma alatum* PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 110 in part.
1878. *Choanopoma alatum* ARANGO, Contribucion a la fauna malacologica Cubana, pp. 13-14 in part.
1890. *Choanopoma alatum* CROSSE, Journ. Conchyl., vol. 38, p. 273 in part.

Shell depressed-helicoid, thin, straw yellow, a little paler on the peristome. Nuclear whorls strongly rounded, smooth except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly inflated, rather depressed, marked by retractively slanting, sublamellar axial riblets, of which 98 occur on the last two whorls. These riblets are slightly expanded into cusps at the summit. Between these distantly spaced sublamellar riblets are finer axial threads, which vary in number from 1 to 7; the spaces between them also vary correspondingly in width. Suture narrowly strongly channeled. Periphery well rounded. Base short, strongly rounded, openly umbilicated, marked by the continuation of the axial riblets and by 2 slender spiral threads adjacent to the umbilicus. The axial riblets continue into the umbilicus and here become a little enfeebled and closely spaced, maintaining their arrangement of strong and feeble elements. In addition to the axial riblets there are 7 spiral threads on the umbilical wall, which are of almost equal strength and spacing. Aperture almost circular; peristome double, the inner slightly expanded, reflected over and adnate to the outer, scarcely distinct on the basal and outer lip, but well marked at the posterior angle and on the inner lip; the outer broadly expanded, forming a conspicuous auricle at the posterior angle, which is adnate to the preceding turn. Operculum typically annularid.

The type, U.S.N.M. No. 356303, was collected by Mr. Henderson near Holguin, Oriente Province. It has 3.5 whorls and measures: Length, 8.0 mm.; greater diameter, 10.9 mm.; lesser diameter, 9.0 mm.

We believe that it is the same shell which the authors, whom we quote in our synonymy, refer to as having been collected between Holguin and Barajagua.

ANNULARIA (ANNULARELLA) YUMURIENSIS, new species

PLATE 52, FIGURES 4-6

Shell small, of turbate outline, flesh colored. Nuclear whorls 2, well rounded, microscopically granulose. Postnuclear whorls somewhat inflated, strongly rounded, and marked on the first whorl by rather strong axial riblets and thereafter by axial ribs of two series, namely, strong sublamellar elements, between which fine, threadlike riblets are present. Of the strong axial ribs 59 are present on the first turn, 55 on the second, and 59 on the last. The intercalated riblets vary in number from 3 to 7. The strong axial ribs are not developed into cusps at the summit, but appear to maintain equal strength throughout. Suture slightly channeled. Periphery well rounded. Base short, inflated, strongly rounded, marked by the continuation of the axial ribs only. Base narrowly, openly umbilicated, marked by a strong cord at the outer termination of the umbili-

cus, and by 5 weak cords on the umbilical wall. These do not render the axial riblets nodulose. Last whorl adnate. Aperture broadly ovate; peristome double, the inner and outer narrowly expanded and reflected and coextensive, separated only at the posterior angle, where there is a slight depression between the hood forming the outer peristome and the inner. Operculum typically annularid.

The type, U.S.N.M. No. 535646, was collected at Boca de Yumuri, Oriente Province, by Arango. It has 4.8 whorls and measures: Length, 9.0 mm.; greater diameter, 6.5 mm.; lesser diameter, 5.8 mm.

ANNULARIA (ANNULARELLA) NIPENSIS, new species

PLATE 52, FIGURES 7-9

Shell strongly turbinate, pale yellow. Nuclear whorls almost 2, strongly rounded, smooth, except for the last portion of the last turn, which shows the beginning of the axial riblets. Postnuclear whorls very strongly elevated, strongly rounded, and marked by sublamellar axial riblets, of which 72 occur on the first, 56 on the second, and 64 on the last. The sublamellar riblets are slightly expanded at the summit; the spaces between them on the last two whorls are marked by rather strong axial threads, which vary from 2 to 6 in number. The spaces separating these sublamellar axial riblets vary correspondingly in width. Suture scarcely channeled. Base short, inflated, well rounded, openly umbilicated, marked by the continuation of the axial ribs. The umbilical wall is marked by the closely crowded continuation of the axial riblets and by 9 spiral threads, of which the outermost is a little stronger than the rest. Last whorl solute for about one-fourth of a turn. Aperture broadly oval; peristome double, the outer and inner coextensive on the outer and basal lip; the outer is a little more expanded on the inner and parietal wall, forming an inconspicuous auricle at the posterior angle; at the posterior angle the inner peristome projects as a low shelf. Operculum typically annularid.

The type, U.S.N.M. No. 356324, was collected by Mr. Henderson at Farallones de Nipe (Sabanilla), Oriente Province. It has 4.5 whorls and measures: Length, 12.3 mm.; greater diameter, 11.4 mm.; lesser diameter, 8.2 mm.

ANNULARIA (ANNULARELLA) TANAMENSIS, new species

PLATE 53, FIGURES 1-3

?1878. *Cistula interstitiale* ARANGO, Contribucion a la fauna malacologica Cubana, p. 22, in part.

?1890. *Cistula interstitiale* CROSSE, Journ. Conchyl., vol. 38, p. 286, in part.

Shell turbinate, thin, last whorl semitranslucent; the early whorls rose red, the last pale straw colored, a little more yellowish within the aperture. Nuclear whorls almost 2, smooth, well rounded, except

for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls strongly rounded, the first one marked by 42 rather distantly spaced axial threads, while on the second there are 64. On this turn intercalated ribs between the stronger are making their appearance. These become much more strongly developed on the last turn, where 112 are present. Suture deeply channeled. Periphery strongly rounded. Base well rounded, openly umbilicated, marked by a strong spiral cord at the junction of the base and umbilicus. The umbilical wall is marked by the continuation of the axial riblets, which here become considerably enfeebled, and 5 feeble spiral threads. Last whorl solute for one-fourth of a turn. Aperture broadly oval; peristome double, the outer broadly expanded, forming a conspicuous auricle at the posterior angle; the inner moderately exerted, strongly reflected all around except at the posterior angle and almost appressed to the outer peristome. Operculum typically annularid.

The type, U.S.N.M. No. 356284, collected by Arango, comes from the ancient Ingenio El Coco, Sagua de Tánamo, Oriente Province. It has 4.9 whorls and measures: Length, 9.4 mm.; greater diameter, 10.3 mm.; lesser diameter, 7.4 mm. A topotype, U.S.N.M. No. 356285, has 4.3 whorls and measures: Length, 8.8 mm.; greater diameter, 10.4 mm.; lesser diameter, 9.6 mm.

This species can easily be distinguished from the others by the conspicuous reddish coloring of the tip.

ANNULARIA (ANNULARELLA) LIBANOENSIS, new species

PLATE 53, FIGURES 7-9 .

Shell rather large, broadly turbinate, flesh colored. Nuclear whorls a little more than 2, strongly rounded, forming a well elevated apex, which conforms with the outline of the rest of the spire, and which has the whorls microscopically granulose. Postnuclear whorls well rounded, marked by retractively curved axial riblets, in which the stronger elements are scarcely differentiated from the intercalated riblets. Of these riblets 41 occur on the first turn, 69 on the second, and 174 on the third and two-tenths whorls completing the spire. These riblets terminate at the summit in slender cusps. Suture narrowly but rather deeply channeled. Periphery slightly angled. Base short, well rounded, and marked by the continuation of the axial riblets and by a weak spiral thread posterior to the strong cord, limiting the umbilicus. The base is openly umbilicated, and shows many spiral threads, as well as the closely crowded axial riblets, on the umbilical wall. The last whorl is solute for about one-tenth of a turn. Aperture almost circular; peristome double, the inner peristome quite strongly exerted and reflected to fuse with the outer on the outer lip; outer peristome moderately, broadly expanded on the outer lip, more

so on the inner lip, and decidedly so at the posterior angle, where it forms a hood, the posterior angle of which touches the preceding whorl. The inner lip at the posterior angle forms a decided shelf, leaving a deep triangular pit at the posterior angle. Operculum typically annularid.

The type, U.S.N.M. No. 535648, comes from Alto del Cedrito, Monte Libano, Oriente Province. It has 5.3 whorls and measures: Length, 12.9 mm.; greater diameter, 12.5 mm.; lesser diameter, 9.5 mm.

ANNULARIA (ANNULARELLA) NATENSONI, new species

PLATE 53, FIGURES 4-6

Shell small, turbinate, pale yellow. Nuclear whorls 2, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by slender axial threads on the first half whorl, after which the axial sculpture becomes differentiated into two types, namely, distantly, rather irregularly spaced, sublamellar ribs, between which occur finer axial threads. Thirty-four of the strong ribs occur on the second whorl and 31 are on the last eight-tenths of the last turn. The finer threads between the lamellar ribs vary in number from 3 to 10. Suture strongly constricted. Periphery of the last whorl inflated, well rounded. Base short, inflated, well rounded, openly umbilicated, marked by the continuation of the axial ribs, which extend prominently into the umbilicus. A feeble spiral thread marks the outer limit of the umbilicus. The umbilical wall itself is free of spiral sculpture. The last whorl is solute for about one-eighth of a turn. Aperture subcircular; peristome double, the inner reflected over the outer on the outer basal and inner lip, forming a shelf at the posterior angle of the aperture; the outer moderately expanded and almost the same width except at the posterior angle, where it forms an auricle. Operculum typically annularid.

The type, U.S.N.M. No. 535650, was collected by Natenson at Silla de Baez west of Baracoa, Oriente Province. It has 4.9 whorls and measures: Length, 7.5 mm.; greater diameter, 7.4 mm.; lesser diameter, 6.2 mm.

ANNULARIA (ANNULARELLA) INTERSTITIALIS ([Gundlach] Pfeiffer)

PLATE 54, FIGURES 4-6

1859. *Cyclostoma (Cistula) interstitiale* [Gundlach] PFEIFFER, Malakozool. Blätter, vol. 6, p. 74.
 1861. *Cistula interstitiale* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.
 1920. *Tudora (Tudorellata) interstitialis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell turbinate, thin, semitranslucent, yellowish white, a little darker on the early turns than the last. Nuclear whorls 2, well

rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by strong, sublamellar axial ribs which are expanded into slight auricles at the summit. The spaces between these sublamellar ribs are marked by additional axial riblets, which are almost as strong as the stronger elements. Of these 1 to 3 may occur between the stronger. Suture deeply channeled. Periphery inflated, strongly rounded. Base short, strongly rounded, marked by the continuation of the axial sculpture. There is a strong spiral cord at the junction of the base and the umbilicus. Here the axial riblets crossing it form feeble elongated nodules. On the umbilical wall the axial sculpture becomes slightly enfeebled. Last whorl solute for a tenth of a turn. Aperture broadly oval; peristome double, the inner a little heavier, slightly exerted and slightly reflected; the outer thin, transparent, slightly expanded. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 356277, is one of 3 received from Gundlach. It has 4.9 whorls and measures: Length, 9.8 mm.; greater diameter, 10.7 mm.; lesser diameter, 8.4 mm.

This species was collected by Gundlach at Cafetales de Yateras, Oriente Province. He says of the animal (Malakozool. Blätter, vol. 6, p. 74, 1859): "It is whitish with whitish dots upon the head and at the base of the feelers. The head is somewhat reddish within. The feelers have a dark tip. The body is marked by various blackish spots which are visible through the shell."

ANNULARIA (ANNULARELLA) TOROENSIS, new species

PLATE 54, FIGURES 1-3

Shell turbate, straw colored, a little more deeply yellow within the aperture. Nuclear whorls 2, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, the first marked by 48, rather distantly spaced, axial riblets, while on the next two whorls intercalated slender threads make their appearance, which raise the number of riblets on the second whorl to 104, and on the last to 156. Suture strongly channeled. Periphery well rounded. Base short, very broadly, openly umbilicated, marked by the continuation of the axial riblets, and by a strong spiral cord at its anterior margin. The umbilical wall is marked by the continuation of the axial ribs, which here become much enfeebled, and by 8 spiral threads. Last whorl solute for about one-eighth of a turn. Aperture broadly oval; peristome double, the outer narrowly expanded and reflected; the inner moderately, strongly exerted, and but slightly reflected. Operculum typically annularid.

The type, U.S.N.M. No. 356288, was collected by Dr. Ramsden at Embrita, Monte Toro, Oriente Province. It has 4.8 whorls and measures: Length, 10.0 mm.; greater diameter, 10.8 mm.; lesser diameter, 8.2 mm.

ANNULARIA (ANNULARELLA) MAYENSIS Torre and Ramsden

PLATE 55, FIGURES 7-9

1914. *Annularia mayensis* TORRE and RAMSDEN, Nautilus, vol. 28, p. 50.

1920. *Tudora (Tudorellata) mayensis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 75.

Shell helicoid, straw colored. Nuclear whorls almost 2, well rounded, smooth, except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by rather strong, retractively curved, axial, sublamellar riblets, of which 90 occur on the second and 102 on the last whorl. These riblets become slightly expanded at the summit. On the last whorl finer threads occur between the sublamellar threads, which vary from 2 to 5 in number. The spaces separating the coarser threads also vary correspondingly in width. Suture narrowly channeled. Periphery well rounded. Base short, well rounded, marked by the continuation of the axial riblets. Umbilicus broadly open, the umbilical wall marked by the continuation of the closely crowded axial riblets and by 13 spiral threads, which render the axial riblets slightly nodulose at their junction; the outermost spiral thread is considerably stronger than the rest. Last whorl solute for about one-tenth of a turn. Aperture broadly oval; peristome double, the inner almost coextensive with the outer except at the posterior angle, where it forms a conspicuously projecting shelf; the outer narrowly expanded but forming a conspicuous auricle at the posterior angle. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 356320, is one of 2 topotypes collected by Dr. Ramsden. It comes from "La Isabelita," La Maya, Oriente Province. It has a little over 3 whorls and measures: Length, 10.0 mm.; greater diameter, 12.8 mm.; lesser diameter, 9.8 mm.

ANNULARIA (ANNULARELLA) YUNQUENSIS (Pfeiffer)

PLATE 55, FIGURES 1-3

1860. *Cyclostoma yunquense* PFEIFFER, Malakozool. Blätter, vol. 7, p. 26.

1861. *Choanopoma yunquense* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.

1920. *Annularia (Annularella) yunquensis* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 73.

Shell turbinate, thin, translucent, yellowish flesh colored. Nuclear whorls almost 2, well rounded, smooth. Postnuclear whorls increas-

ing very rapidly in size, inflated, strongly rounded, marked by retractorily slanting axial riblets, of which 72 occur on the first turn. On the succeeding turns the axial riblets become specialized into two series, one strong and sublamellar and the other weak and threadlike. Of the strong riblets, 62 occur on the second turn and 64 are on the last, while the spaces between these riblets are marked by 2 to 7 of the finer threads. Suture slightly constricted. Periphery strongly rounded. Base short, inflated, strongly rounded, with a very broad, almost funnellike umbilicus, marked by the continuation of the axial riblets, which extend into the umbilicus, and by 3 spiral threads, of which the last one marks the junction of the umbilicus and the base, and it is much stronger than the other two; within the umbilicus 4 feeble additional spiral threads are present. Last whorl solute for one-fourth of a turn. Aperture almost subcircular; peristome double, the inner exerted and reflected; the outer narrowly expanded, slightly fluted at the junction of the basal and inner lips, of the same width all around except at the posterior angle, where it forms a rather broad auricle. Operculum typically annularid.

The specimen described and figured, U.S.N.M. No. 11017, is one of 5 collected by C. Wright at Yunque de Baracoa, Oriente Province. It has 4.9 whorls and measures: Length, 9.1 mm.; greater diameter, 8.8 mm.; lesser diameter, 6.9 mm.

ANNULARIA (ANNULARELLA) WRIGHTI, new species

PLATE 55, FIGURES 4-6

Shell small, turbinate, pale straw colored. Nuclear whorls 2, well rounded, smooth except for the last portion of the last turn which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, rather high, marked by strong, retractorily slanting, sublamellar axial ribs, of which 54 occur on the second and 64 on the last. These axial riblets are expanded into moderately broad cusps at the summit, which do not become appressed to the preceding turns. Between the sublamellose axial riblets are finer axial threads which vary from 2 to 4 in number. Suture narrowly channeled. Periphery well rounded. Base short, inflated, strongly rounded, narrowly, openly umbilicated, marked by the continuation of the closely crowded axial riblets and by 7 rather strong spiral threads on the umbilical wall of which the outer is the heavier. Last whorl solute for about one-fourth of a turn. Aperture broadly oval; peristome double, the outer coextensive on the outer lip, projecting slightly on the inner lip and at the posterior angle as a narrowly developed auricle; on the inner lip and at the posterior angle the inner peristome is slightly exerted. Operculum typically annularid.

The type, U.S.N.M. No. 356328, was collected by C. Wright east of Ermitage, between Santiago and Guantánamo, Oriente Province. It has 4.5 whorls and measures: Length, 10.0 mm.; greater diameter, 9.5 mm.; lesser diameter, 6.9 mm.

ANNULARIA (ANNULARELLA) MAYARIENSIS, new species

This species is differentiated from the rest of the Annularellas by having the last whorl solute, the inner lip of the outer peristome narrow, the umbilical wall with many spiral threads, and with the interstitial axial threads numerous and fine, and a weak auricle at the posterior angle of the aperture.

The three subspecies here recognized come from the limestone blocks inland from Nipe Bay, Oriente Province:

KEY TO THE SUBSPECIES OF ANNULARIA (ANNULARELLA) MAYARIENSIS

Shell pale orange.....	welchi
Shell yellowish white.	
Shell broadly turbinate.....	mayariensis
Shell narrowly turbinate.....	canapuensis

ANNULARIA (ANNULARELLA) MAYARIENSIS WELCHI, new subspecies

PLATE 56, FIGURES 4-6

Shell broadly turbinate, pale orange. Nuclear whorls 2, inflated, well rounded, smooth, except for the last part of the last turn, which shows the beginning of the postnuclear sculpture. The first of the postnuclear whorls is marked by 52 slender, retractively curved, axial riblets. On the last part of the first postnuclear turn the fine interstitial axial threads make their appearance. These increase steadily in size and on the last turn they are also of sublamellar nature and are scarcely differentiated from the larger lamellae. There are 214 riblets on the last turn. Suture fairly strongly channeled. Periphery inflated, strongly rounded. Base short, strongly rounded, marked by the continuation of the axial ribs, which are crowded over the umbilical wall. The umbilical wall also bears 9 spiral threads, of which the outer one is the strongest. The last whorl is solute for about one-fifth of a turn. Aperture subcircular; peristome double, the outer and inner apparently coextensive except at the posterior angle, where the inner forms a slight shelf, and the outer projects as a narrow auricle. Operculum typically annularid.

The type, U.S.N.M. No. 535632, comes from a hill north of Miranda in the Mercedes Valley, Oriente Province. It has 5 whorls and measures: Length, 12.7 mm.; greater diameter, 14.0 mm.; lesser diameter, 9.3 mm.

ANNULARIA (ANNULARELLA) MAYARIENSIS MAYARIENSIS, new subspecies

PLATE 56, FIGURES 1-3

1865. *Cistula interstitialis* β PFEIFFER, Monographia pneumonopomorum viventium, suppl. 2, p. 141.
1878. *Cistula interstitialis* ARANGO, Contribucion a la fauna malacologica Cubana, p. 22, in part.
1890. *Cistula interstitialis* CROSSE, Journ. Conchyl., vol. 38, p. 286, in part.

Shell broadly turbinate, almost helicoid, pale straw colored. Nuclear whorls almost 2, well rounded, smooth except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls inflated, strongly rounded, marked by retractively slanting, sublamellar axial riblets, of which 66 occur on the first turn, where they are all of about the same strength and spacing; on the second there are 72 of the stronger riblets, and between these the finer threads are well developed; on the last whorl 70 of the stronger riblets are present, with the finer threads attaining almost one-third the strength of the sublamellar riblets; these vary in number from 2 to 5, and the spaces separating the coarser riblets vary correspondingly. The coarser riblets are slightly expanded at the summit. Suture moderately channeled. Base short, strongly rounded, openly umbilicated, marked by the continuation of the axial riblets. The umbilical wall is marked by the closely crowded axial riblets and by 10 spiral threads, of which the outer one is about twice as strong as the rest. The junction of the stronger axial riblets and the spiral threads forms feeble nodules on the umbilical wall. Last whorl solute for about one-fifth of a turn. Aperture broadly oval; peristome double, the inner slightly expanded and coextensive on the basal and outer lip, a little narrower on the inner lip, projecting as a conspicuous shelf at the posterior angle; the outer slightly expanded, forming a conspicuous auricle at the posterior angle. Operculum typically annularid.

The type, U.S.N.M. No. 356321, was collected by C. Wright at Cayo del Rey, Mayarí, Oriente Province. It has 4.5 whorls and measures: Length, 11.5 mm.; greater diameter, 12.8 mm.; lesser diameter, 10.3 mm.

ANNULARIA (ANNULARELLA) MAYARIENSIS CANAPUENSIS, new subspecies

PLATE 57, FIGURES 7-9

Shell narrowly turbinate, yellowish white. Nuclear whorls almost 2, well rounded, smooth except for the last portion of the last turn, which shows the beginning of the postnuclear sculpture. Postnuclear whorls rather high between the sutures, inflated, strongly rounded, marked by decidedly retractively slanting, sublamellar axial riblets, of which 66 occur on the first, 52 on the second, and 79 on the last

whorl. These sublamellar riblets are strongly expanded at the summit, the expanded portion being adnate to the preceding turn as slender auricles. Between these sublamellar riblets quite strong axial threads are present, which vary from 2 to 4 in number. Suture well constricted. Base short, inflated, strongly rounded, broadly, openly umbilicated, and marked by the continuation of the axial riblets. The umbilical wall is marked by the closely approximated axial riblets and by 10 feeble spiral threads, which are rather irregularly spaced, and of which the outer is the strongest. Last whorl solute for one-fourth of a turn. Aperture broadly oval; peristome double, the inner and outer coextensive on the outer and basal lip, slightly separated on the inner lip, and more so on the parietal wall; the outer forms a weak auricle at the posterior angle of the aperture. Operculum typically annularid.

The type, U.S.N.M. No. 356326, was collected by Mr. Henderson at Farallones de Canapú, near Cayo del Rey, Oriente Province. It has 5.0 whorls and measures: Length, 10.8 mm.; greater diameter, 10.3 mm.; lesser diameter, 8.0 mm.

Subgenus *CHONDROPOMATUS* Henderson and Bartsch

1920. *Chondropomatus* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 59.

Shell of turbate form, marked by strong axial ribs, between which finer threads parallel to the ribs are present. The axial sculpture extends into the open umbilicus, the wall of which is marked by strong spiral cords. Operculum with the merest indication of the beginning of a lamella.

Type: *Annularia* (*Chondropomatus*) *lata* ([Gundlach] Pfeiffer).

Henderson and Bartsch created the above subgenus for *Cyclostoma latum* (Gundlach) Pfeiffer and placed it in the genus *Chondropoma* of the subfamily Chondropominae. Much additional material now causes a realignment of this group. All the characters of the shell, with the exception of the operculum, are those of the subgenus *Annularella*, of the genus *Annularia*, in which genus it is now placed, since it is believed that the reduction of the lamella to the vanishing point or even its absence had best be considered a specialization along the line of reduction, rather than an expression of a phylogenetic relationship. This realignment is also confirmed by the zoogeographic position of the group.

KEY TO THE SPECIES OF THE SUBGENUS *CHONDROPOMATUS*

Peristome white.....	<i>lata</i>
Peristome yellow.....	<i>mimetica</i>

ANNULARIA (*CHONDROPOMATUS*) *LATA* ([Gundlach] Pfeiffer)

PLATE 57, FIGURES 4-6

1858. *Cyclostoma latum* [GUNDLACH] PFEIFFER, Malakozool. Blätter, vol. 5, p. 190.
1861. *Chondropoma latum* BLAND, Ann. Lyceum Nat. Hist. New York, vol. 7, p. 27.
1920. *Chondropoma (Chondropomatus) latum* HENDERSON and BARTSCH, Proc. U. S. Nat. Mus., vol. 58, p. 59.

Shell broadly helicoid, with well elevated spire, flesh colored, the nuclear turns and the first postnuclear turns pale brown. Nuclear whorls 1.9, strongly rounded, inflated, very finely granulose. Post-nuclear whorls strongly rounded, rather high, with a deep channel at the summit, which is bordered anteriorly by a pronounced carina, which is very feeble on the first postnuclear turn, but which increases in strength from there on. The postnuclear whorls are marked by strong, sublamellar, retractively slanting axial ribs, which are of decidedly uniform strength and spacing. The spaces between these sublamellar ribs are marked by axial threads, which coincide with the heavier sculpture in disposition. These threads vary from one to five in number. The strong sublamellar axial ribs render the shoulder near the summit weakly crenulated; they do not terminate at the shoulder posteriorly, but extend into the channel at the summit. Suture rendered very pronounced by a channel. Periphery of the last whorl rounded. Base somewhat inflated, well rounded, very deeply, openly umbilicated, the umbilicus occupying about one-fifth of the diameter of the base. The base is marked by the continuations of the axial sculpture described for the spire, while the umbilical wall is marked by 6 strong spiral cords, the first of which is the strongest, and which marks the outer termination of the expanding umbilicus, while the rest are successively a little weaker and closer spaced. Posterior to the strong cord referred to as limiting the umbilicus is another cord, which is considerably weaker. The junctions of these spiral cords and the axial riblets form slender, elongated nodules, having their long axis parallel with the spiral cords. Aperture broadly pyriform; peristome double, the inner and outer coextensive, except at the posterior angle, where the outer forms a conspicuous auricle, while the inner forms a shelf. Sometimes there is a second shelf between these two. Operculum thin, corneous, consisting of 4.5 turns with an excentric nucleus; the outer edge of the last volution is thin and slightly upturned on the columellar border; the entire surface, except the last two turns, has the outer surface covered with a coating of small calcareous granules.

This species comes from Santiago. The specimen figured is U.S.N.M. No. 354945. A summary of the measurements of a series of specimens before us yields the following data:

	Length	Greater diameter	Lesser diameter
	<i>Mm.</i>	<i>Mm.</i>	<i>Mm.</i>
Greatest.....	7.9	8.7	7.0
Least.....	5.3	6.1	5.2
Average.....	6.7	7.2	6.0

Gundlach says of the animal: "Found on the cliffs of the coast of Cuba at the Forts of Morro, Aguadores and Sardinero (about Santiago). The animal is whitish, almost colorless, with whitish dots, particularly on the head and the base of the tentacles. The tip of the snout and the tentacles ochre red, the tip of the tentacles brown; the body of the animal appears greenish with dark spots through the shell. The animal suspends itself from a mucous thread."

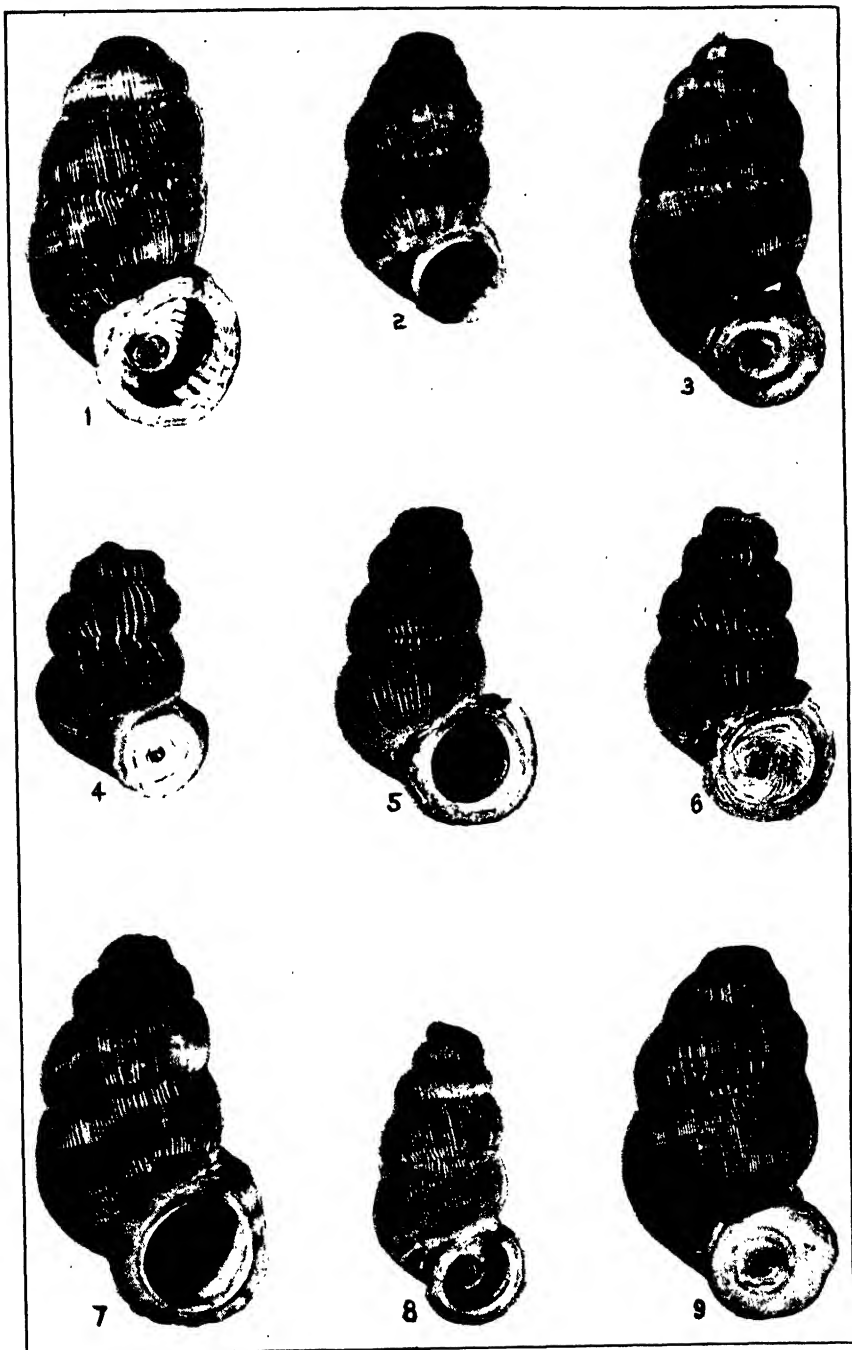
ANNULARIA (CHONDROPOMATUS) MIMETICA, new species

PLATE 57, FIGURES 1-3

Shell subglobular, flesh colored, with an orange tinge and stronger orange shade on the peristome. Nuclear whorls 2, strongly rounded, microscopically granulose. Postnuclear whorls inflated, strongly rounded, marked by retractively curved axial ribs, between which finer axial threads are present. On the first two-thirds of the turn the finer threads are not apparent. The first whorl has 53 ribs, while the last has 67. These ribs terminate at the summit in slender, white tubercles. Of the finer threads from 1 to 4 may be present between the stronger. Suture conspicuously channeled. Periphery strongly rounded. Base inflated, strongly rounded, and marked by the continuation of the axial sculpture. Umbilicus narrow, marked by the continuation of the axial ribs and 8 feeble spiral threads. The one, however, limiting the outer termination of the umbilicus is much stronger than the rest, and it renders the axial riblets here nodulose. Aperture broadly pearshaped; peristome double, the inner and outer coextensive and moderately broadly reflected, separated only on the posterior half of the inner lip by an impressed line, and at the posterior angle, where the inner forms a shelf, while the outer is projected into the conspicuous auricle. Operculum as described for the subgenus.

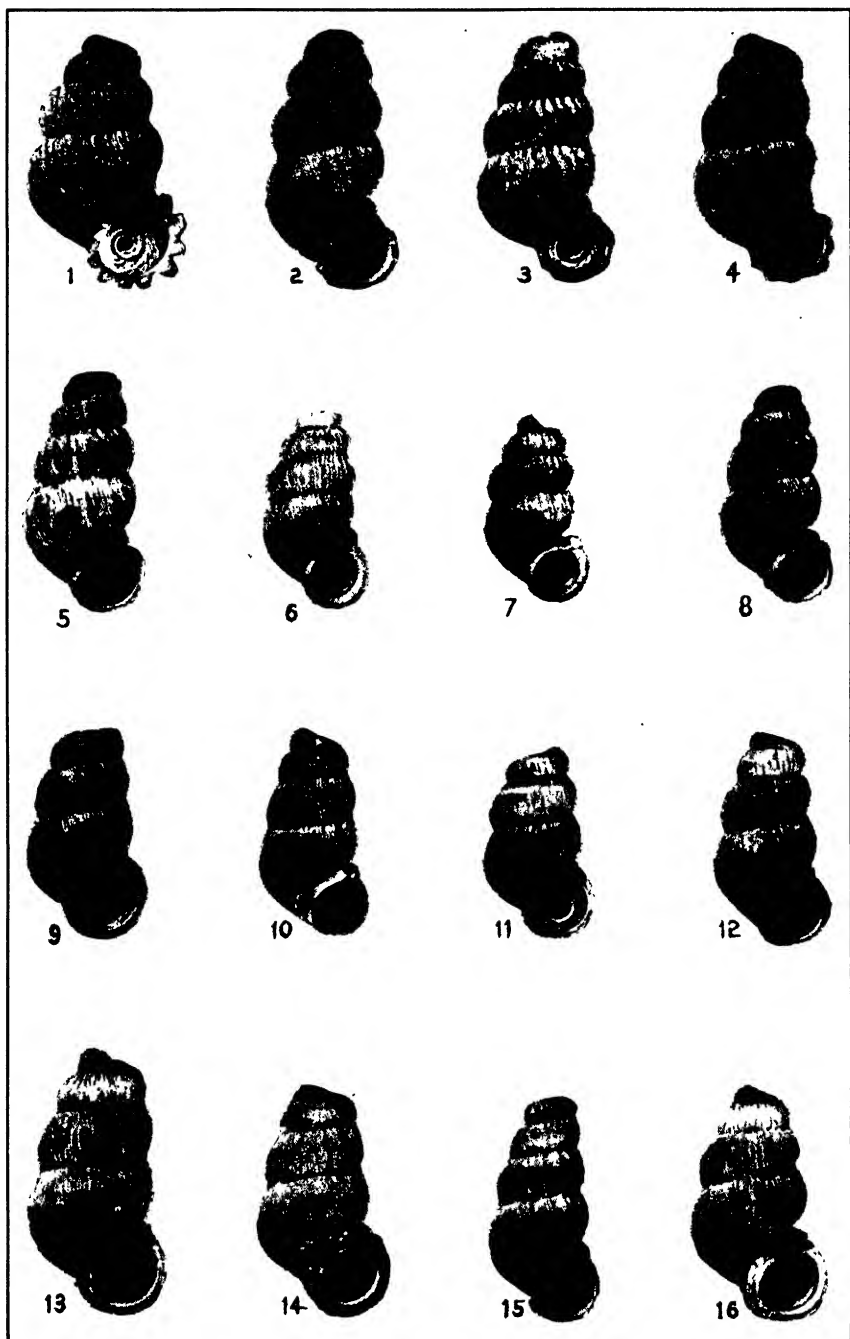
This species was collected in the region of Maisi, Oriente Province, by Dr. Rodriguez.

The type, U.S.N.M. No. 425626, comes from Farrallón de San Lucas. It has 4.8 whorls and measures: Length, 10.2 mm.; greater diameter, 9.6 mm.; lesser diameter, 7.8 mm.



SPECIES AND SUBSPECIES OF OPISTHOCOELEM (X 4).

- 1, *O. (Opisthocoelem) excurrent*; 2, *O. (Opisthocoelex) paradoxum paradoxum*; 3, *O. (O.) p. magnum*; 4, *O. (O.) similans*; 5, *O. (Opisthocoelem) lamellicostatum lamellicostatum*; 6, *O. (O.) mabuyense*; 7, *O. (Opisthocoelem) occultum*; 8, *O. (Opisthocoelem) opisthocoele*; 9, *O. (Opisthocoelex) paradoxum gibbosum*.



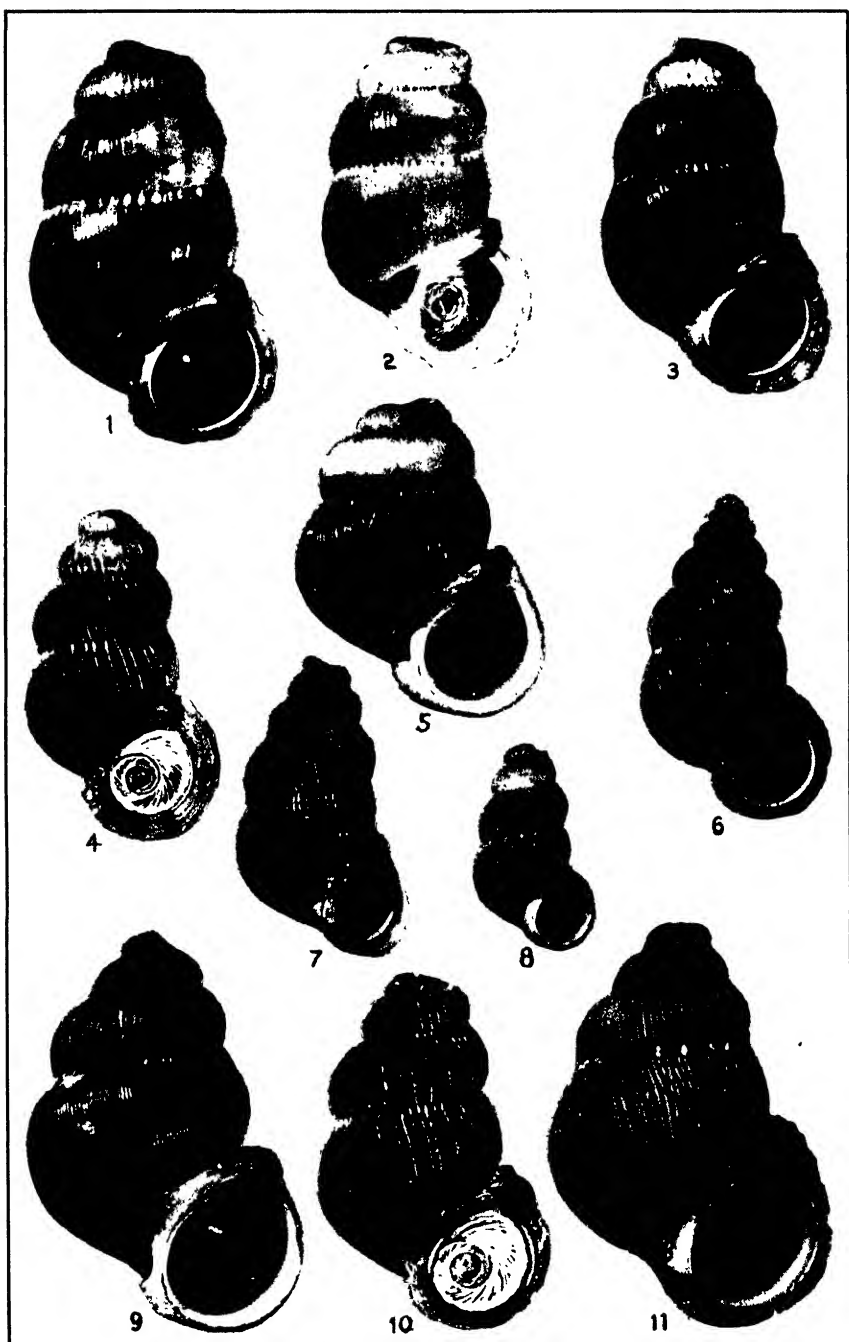
SPECIES AND SUBSPECIES OF TORRELLA AND RHYTIDOPOMA (X 4).

Torrella (*Torrella*) *torreiana*; 2, *T. (T.) immersa immersa*; 3, *T. (T.) i. camaronensis*; 4, *T. (T.) dehtiens*; 5, *T. (T.) immersa grillensis*; 6, *T. (Torrellisca) simpsoni simpsoni*; 7, *T. (T.) c. terneroensis*; 8, *T. (T.) trinidadensis*; 9, *Rhytidopoma nodulatum anafense*; 10, *R. honestum itinerans*; 11, *R. h. nodiferum*; 12, *R. nodulatum nodulatum*; 13, *R. honestum honestum*; 14, *R. coronatum*; 15, *R. nodulatum palenquense*; 16, *R. occidentale*



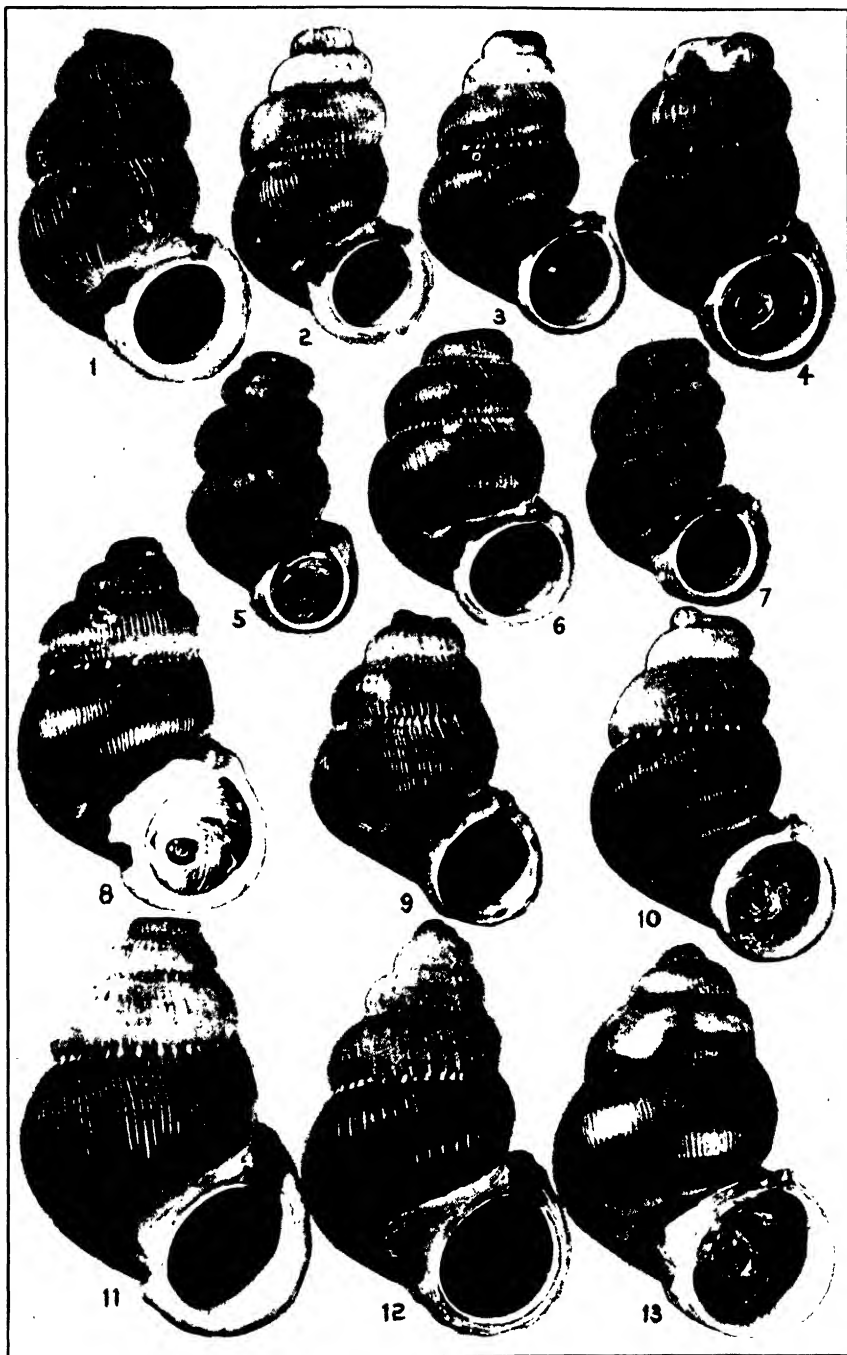
SPECIES AND SUBSPECIES OF RHYTIDOPOMA AND OPISTHOSIPHON (X 4).

- 1, *Rhytidopoma wrightianum wrightianum*; 2, *R. clathratum candelaense*; 3, *R. hespericum*; 4, *R. wrightianum cabraense*; 5, *R. w. ottonis*; 6, *Opisthosiphon (Solutapex) echinatum*; 7, *O. (S.) vainzi*; 8, *R. rugulosum*; 9, *O. (S.) caroli* (nucleus); 10, *R. pinense colombense*; 11, *O. (S.) quesadae*; 12, *O. (S.) caroli*; 13, *R. clathratum jumaguense*; 14, *R. pinense rosarioense*; 15, *R. clathratum clathratum*; 16, *R. pinense ergastulum*; 17, *R. p. pinense*.



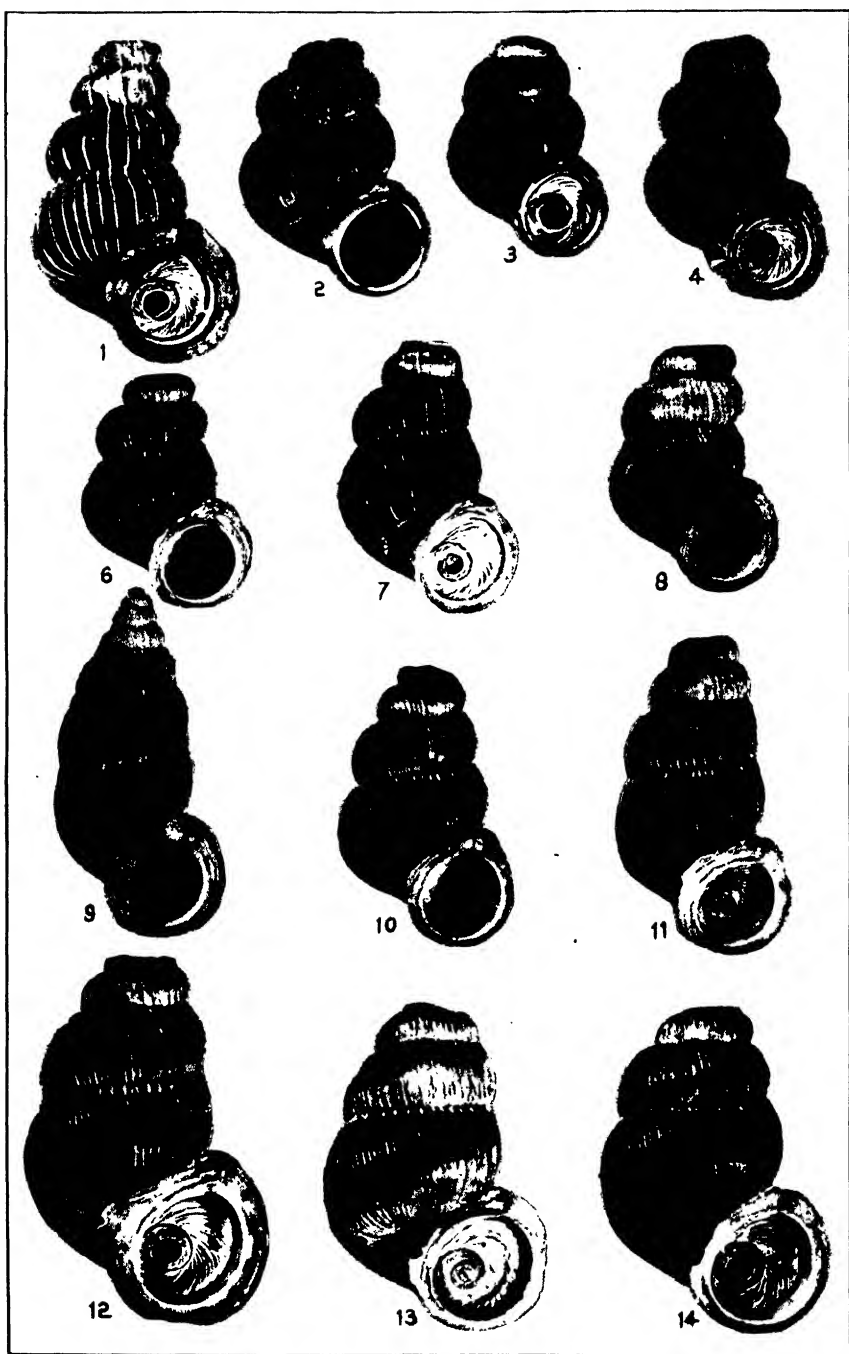
SPECIES AND SUBSPECIES OF OPISTHOSIPHON (X 4)

- 1, *Opisthosiphon (Bermudezophona) palmeri camajanense*; 2, *O. (B.) prominulum*; 3, *O. (B.) palmeri palmeri*; 4, *O. (B.) lamellosum lamellosum*; 5, *O. (B.) banaense banaense*; 6, *O. (B.) lamellosum lower*; 7, *O. (B.) cucullatum*; 8, *O. (Mirisiphon) sculptum*; 9, *O. (B.) banaense trincheranense*; 10, *O. (B.) plateroense*; 11, *O. (B.) greenfieldi*.



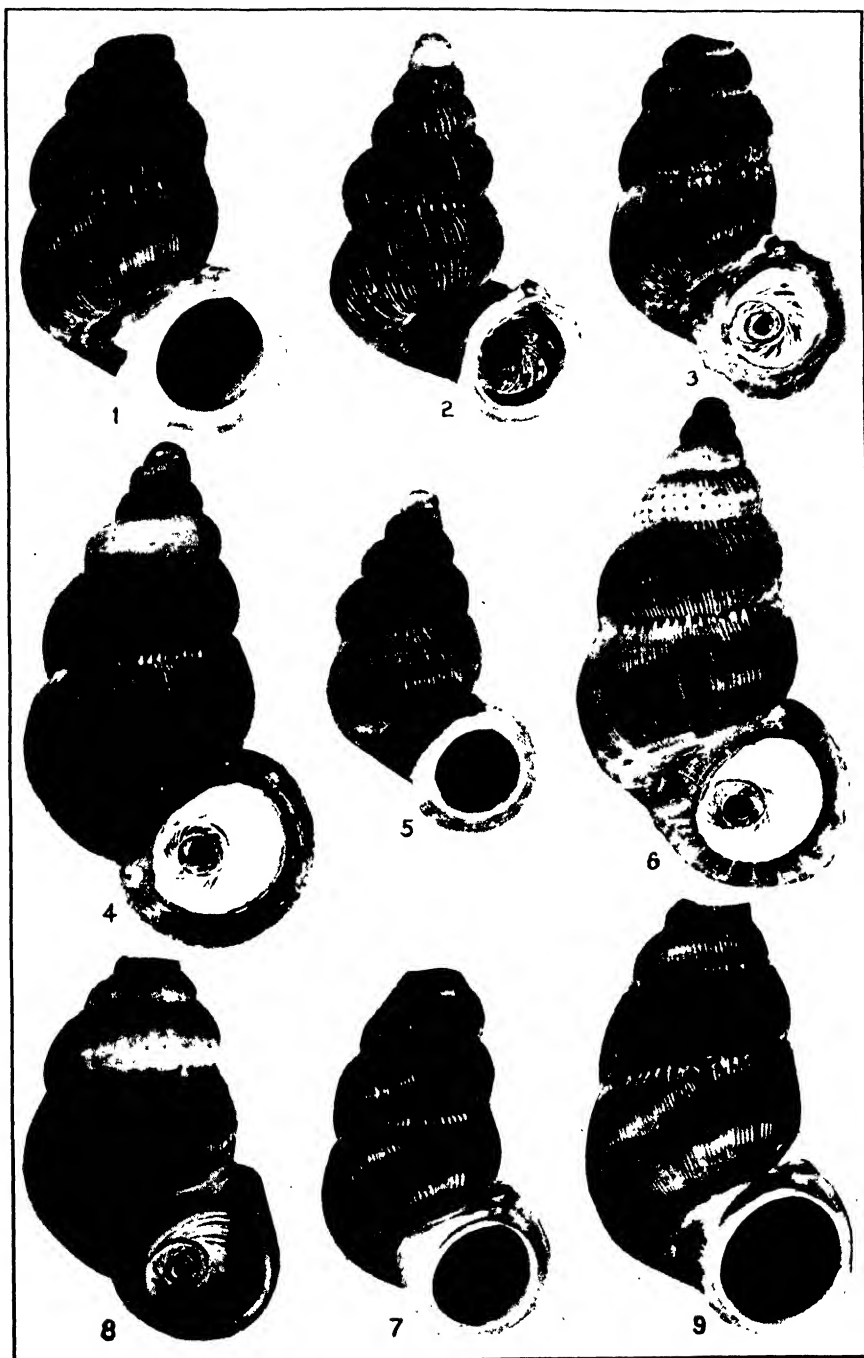
SPECIES AND SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) (X 4).

- 1, *obtectum obectum*; 2, *obtectum guayosense*; 3, *evanidum degeneratum*; 4, *obtectum seibabuense*; 5, *insulanum insulanum*; 6, *obtectum tenuiscostum*; 7, *insulanum scopulorum*; 8, *subobturatum subobturatum*; 9, *salutis*; 10, *evanidum evanidum*; 11, *obturatum obturatum*; 12, *obturatum sulcosum*; 13, *subobturatum tinajaense*.



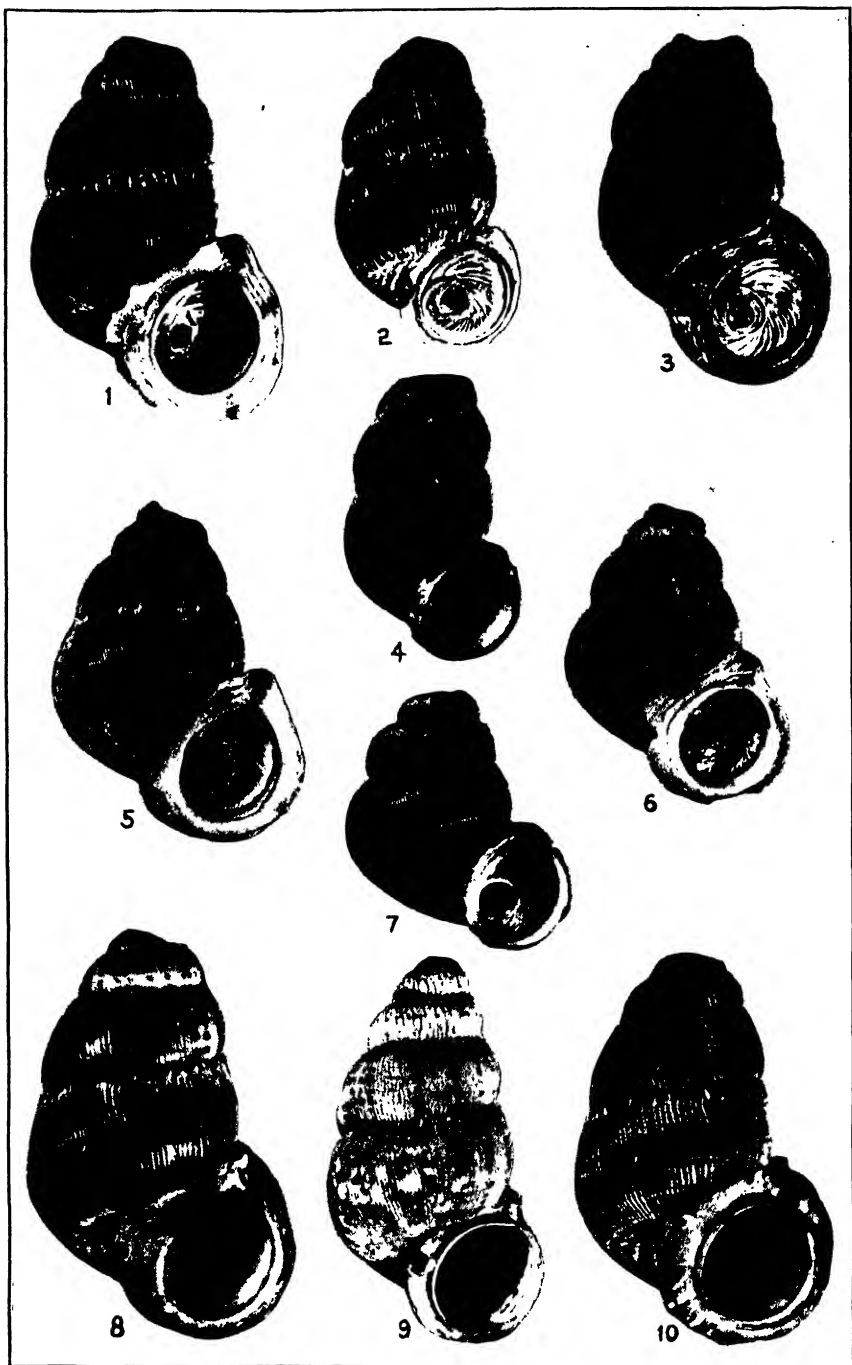
SPECIES AND SUBSPECIES OF OPISTHOSIPHON (BERMUDEZSIPHONA) (X 4).

- 1, *andrewsi*; 2, *subobtectum subobtectum*; 3, *subobtectum punctillense*; 4, *torrei*; 6, *bermudezi*; 7, *detectum lucasense*; 8, *detectum murinum*; 9, *agulerianum agulerianum*; 10, *detectum detectum*; 11, *agulerianum holguinense*; 12, *caganense*; 13, *subobtectum guajabanense*; 14, *subobtectum quintanense*.



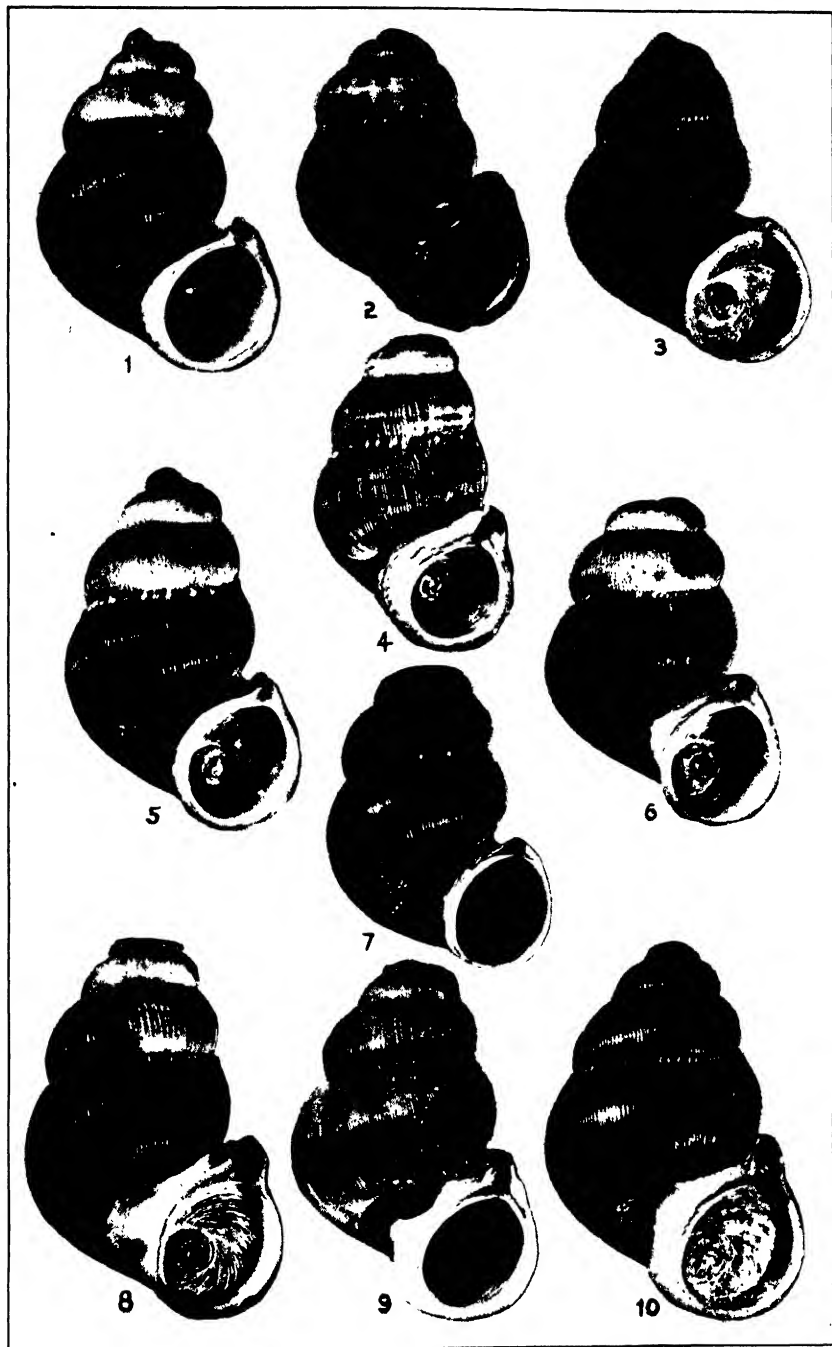
SPECIES AND SUBSPECIES OF OPISTHOSIPHON (X 4).

- 1, *O. (Opisthosiphona) plicatum*; 2, *O. (O.) moreletianum moreletianum*; 3, *O. (O.) pupoides bibijaguaense*; 4, *O. (O.) p. pupoides*; 5, *O. (O.) moreletianum columbense*; 6, *O. (O.) pupoides velazquezii*; 7, *O. (O.) turiguanense*; 8, *O. (Cubitasiphona) poeyi*; 9, *O. (C.) protractum*.



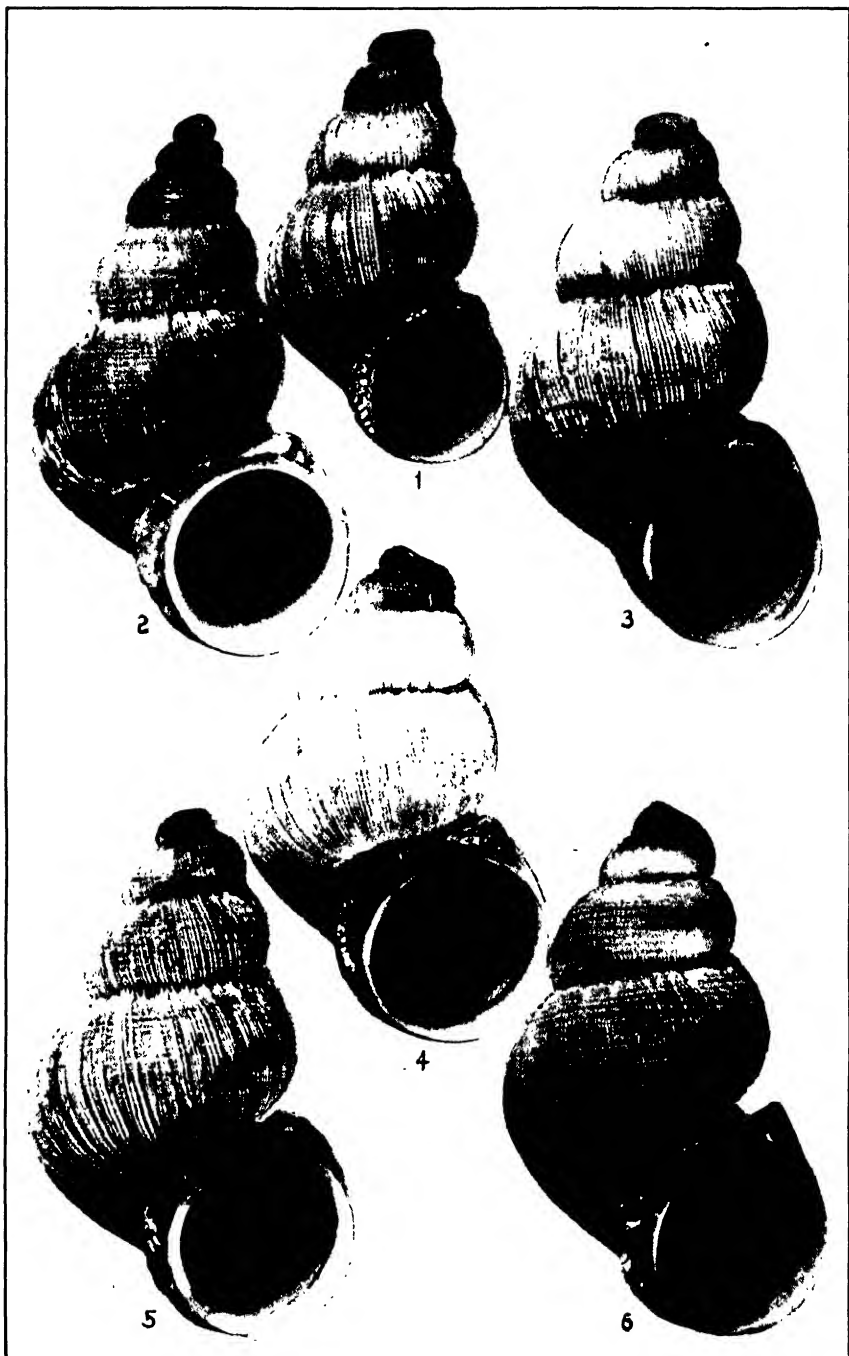
SPECIES OF OPISTHOSIPHON (CUBITASIPHONA) (X 4).

1, *judasense*; 2, *guanajaense*; 3, *cunaguae*; 4, *manatiense*; 5, *sanchezi*; 6, *soyai*; 7, *litorale*; 8, *bivocai*; 9, *claudens*; 10, *quinti*.



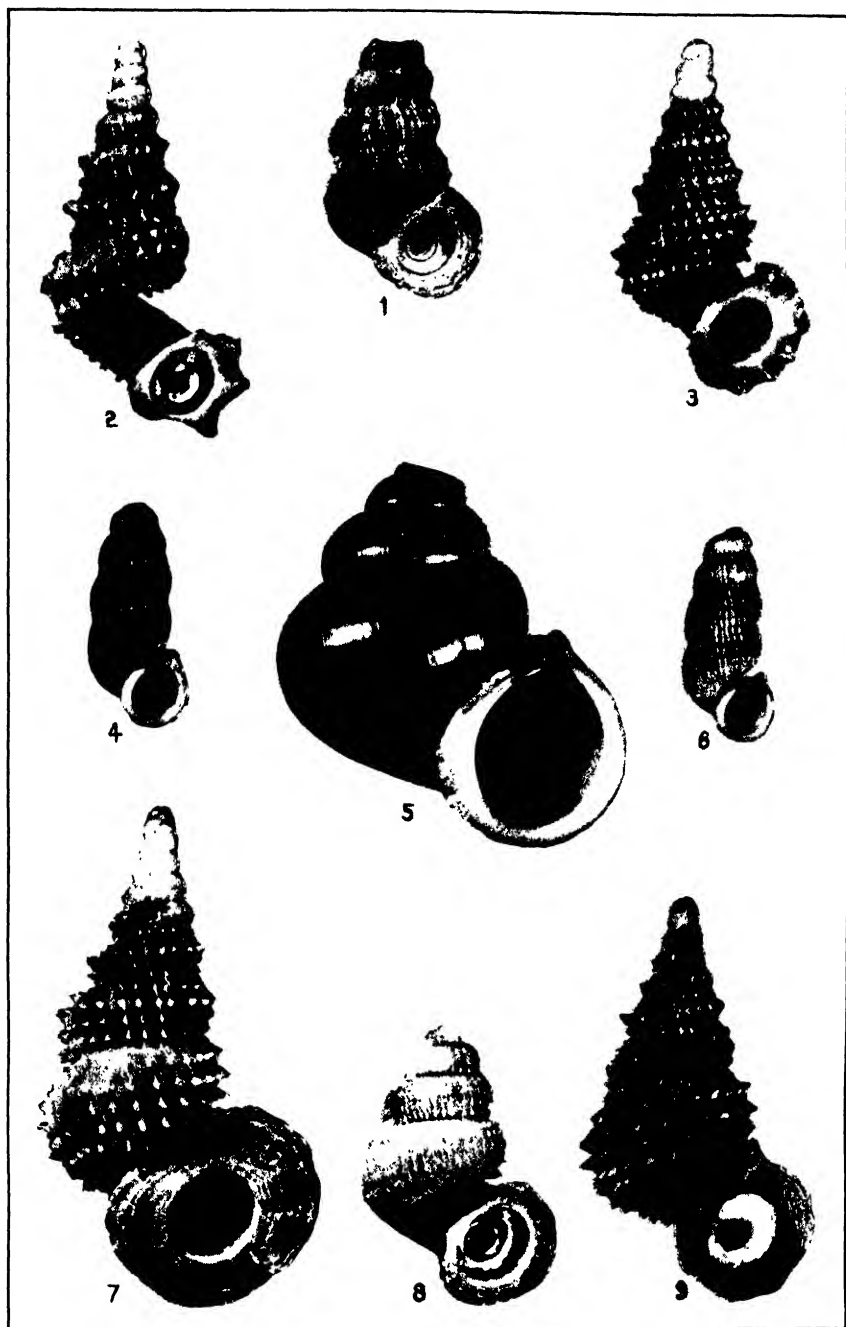
SPECIES AND SUBSPECIES OF OPISTHOSIPHON (CUBITASIPHONA) (X 4).

1, *apertum*; 2, *tersum*; 3, *paredonense escalerense*; 4, *tersum*; 5, *paredonense paredonense*; 6, *berryi transitorium*; 7, *deviatum*; 8, *berryi viguetense*; 9, *berryi berryi* (type of *semiapertum*); 10, *berryi berryi*.



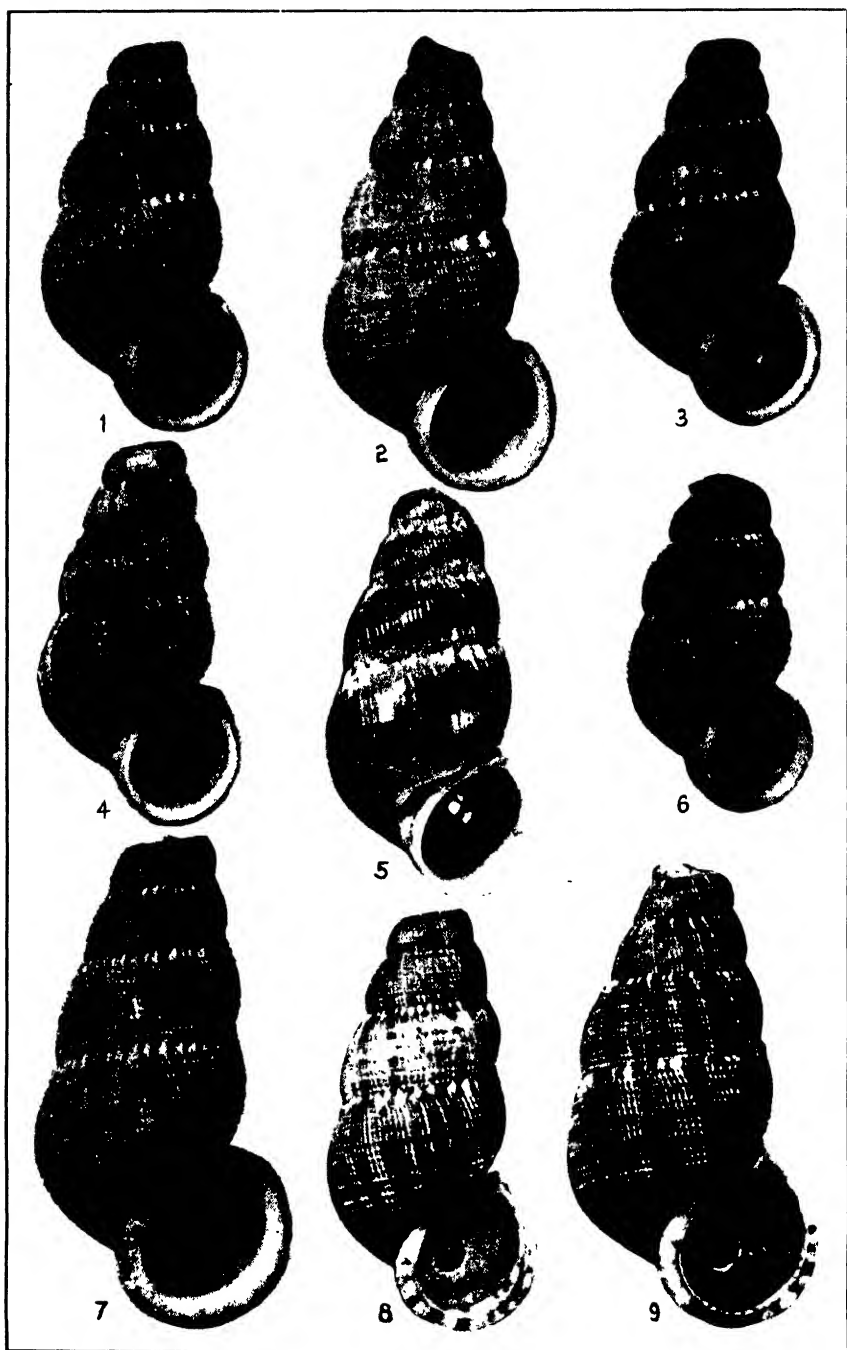
SUBSPECIES OF *RHYTIDOTHYRA BILABIATA* (X 4).

1, *nana*; 2, *rosea*; 3, *straminea*; 4, *aurantiaca*; 5, *rosacea*; 6, *bilabiata*.



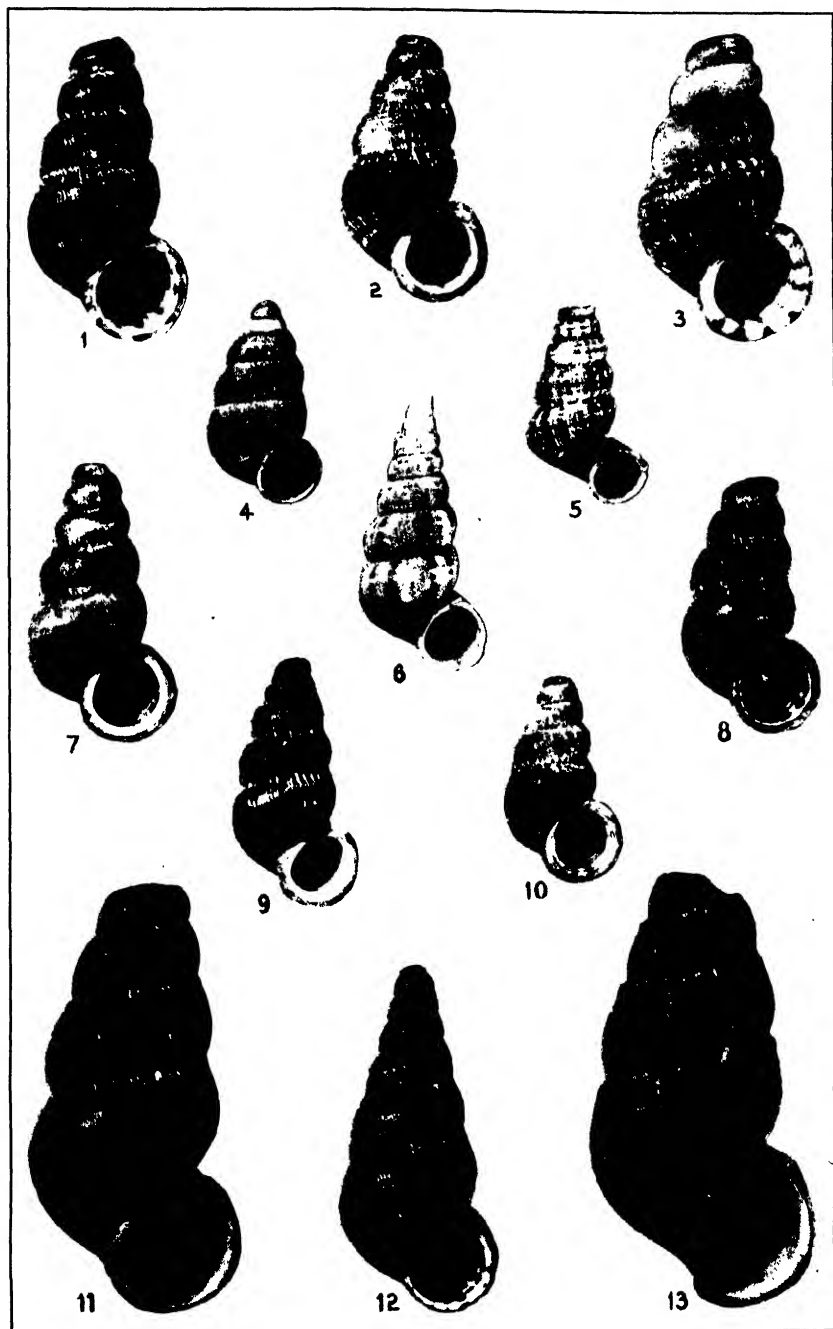
SPECIES AND SUBSPECIES OF XENOPOMOIDES, XENOPOMA, OPISTHOSIPHON, AND DALLSIPHONA (X 4).

- 1, *Xenopomoides delicatulum*; 2, *Xenopoma hystrix*; 3, *Xenopoma hendersoni*; 4, *Opisthosiphon* (*Cylindrosiphona*) *bacillum bacillum*; 5, *O. (C.) b. garciai*; 6, *Dallisiphona dalli*; 7, *Xenopoma aguayoi*; 8, *X. humboldtianum*; 9, *X. spinosissimum*.



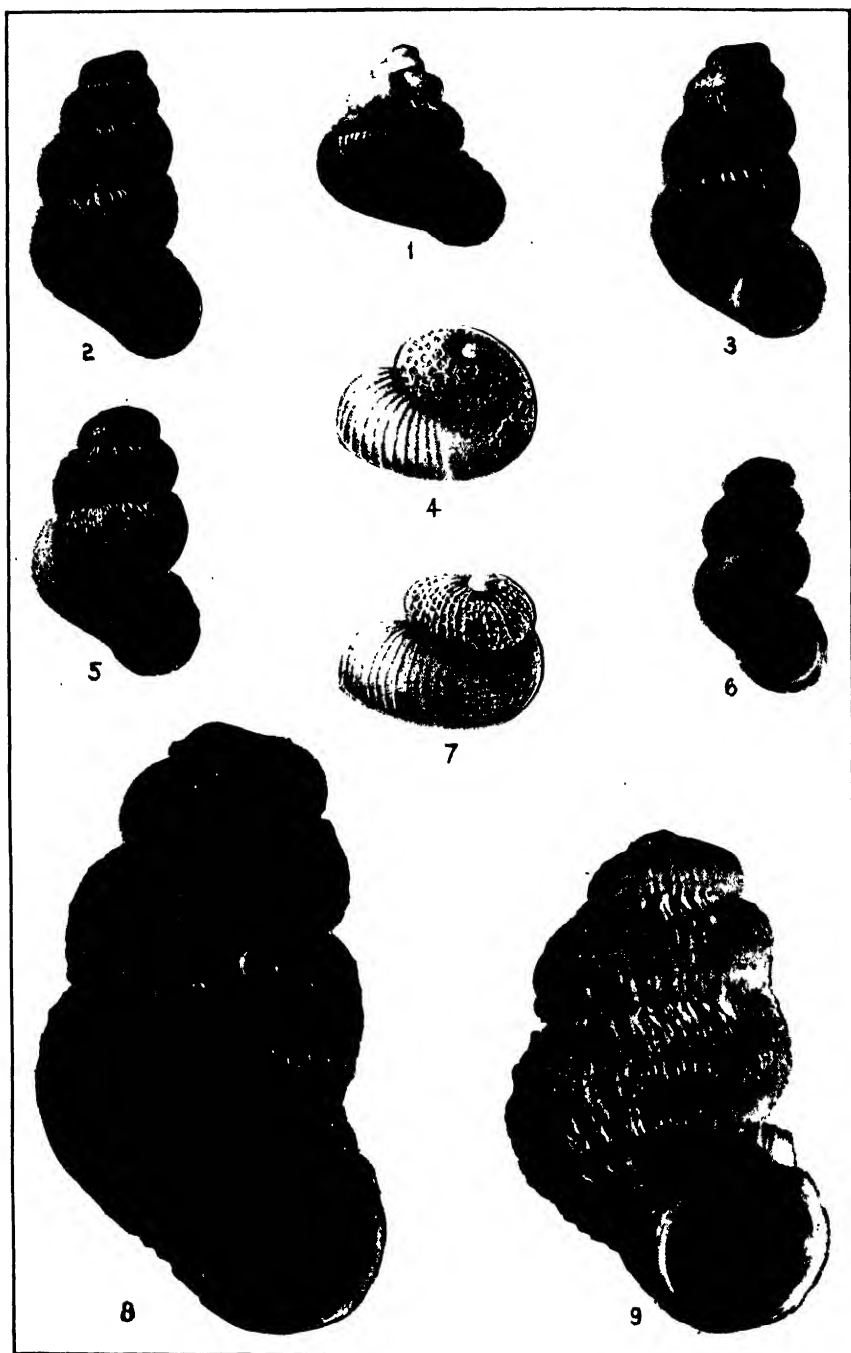
SPECIES AND SUBSPECIES OF PARACHONDRIA (X 4).

- 1, *Parachondria (Parachondropis) erecta mayensis*; 2, *P. (P.) e. erecta*; 3, *P. (P.) e. turquiniensis*; 4, *P. (P.) e. ramonensis*; 5, *P. (P.) wrighti*; 6, *P. (Parachondria) abnata*; 7, *P. (P.) texta texta*; 8, *P. (P.) t. booneae*, 9, *P. (P.) t. portillensis*.



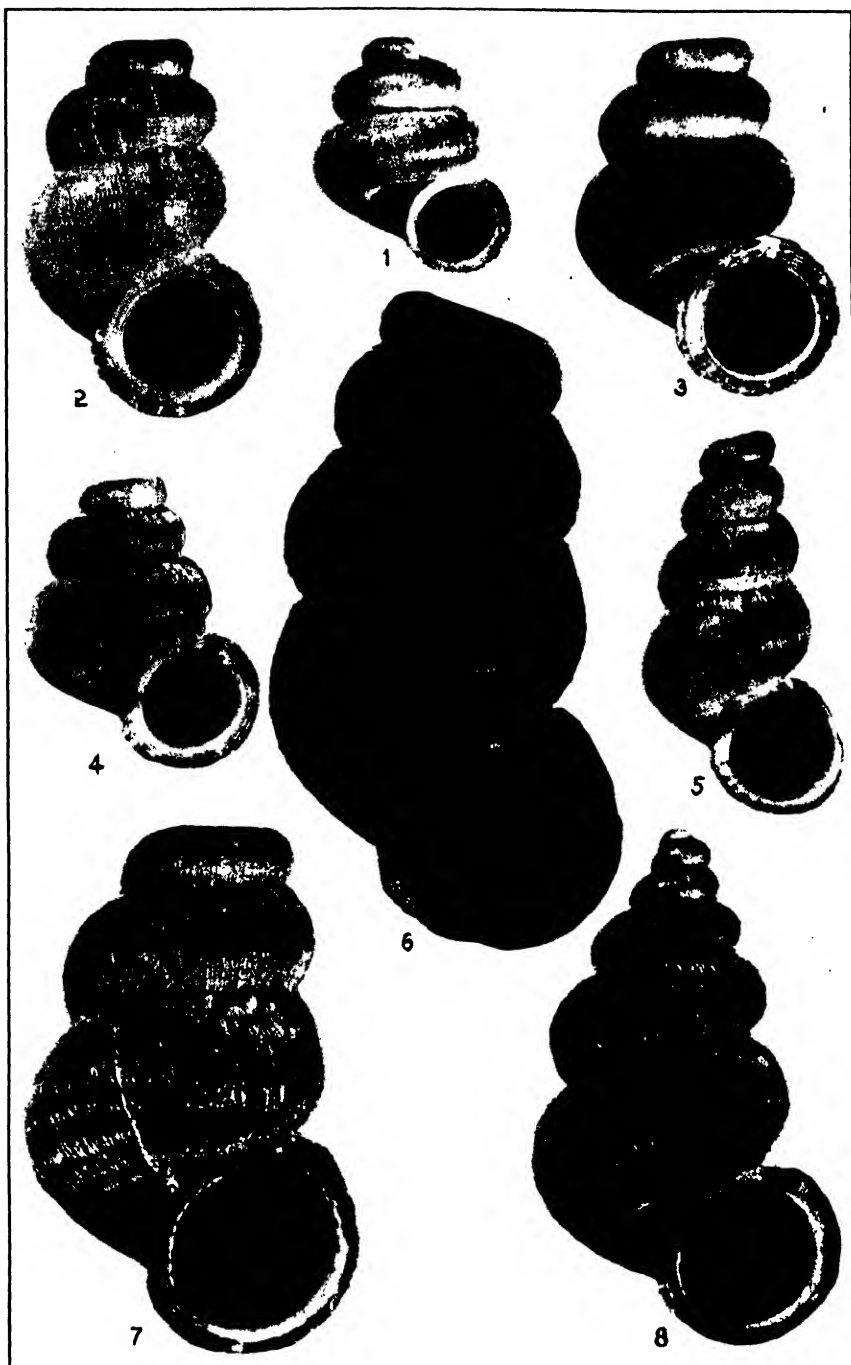
SPECIES AND SUBSPECIES OF PARACHONDRIA AND ADAMSIELLA (X 4).

- 1, *Parachondria* (*Parachondrops*) *chordata chordata*; 2, *P. (P.) c. songoensis*; 3, *P. (P.) c. tanamensis*; 4, *Adamsiella* (*Cubadamsiella*) *gratiosa*; 5, *A. (C.) leoni*; 6, *A. (C.) procax*; 7, *Parachondria* (*Parachondrops*) *nigricula*; 8, *P. (P.) chordata mayariensis*; 9, *P. (P.) daudinoti*; 10, *P. (P.) chordata biracensis*; 11, *P. (P.) abtiana*; 12, *P. (P.) chordata guantanamoensis*; 13, *P. (P.) lurida*.



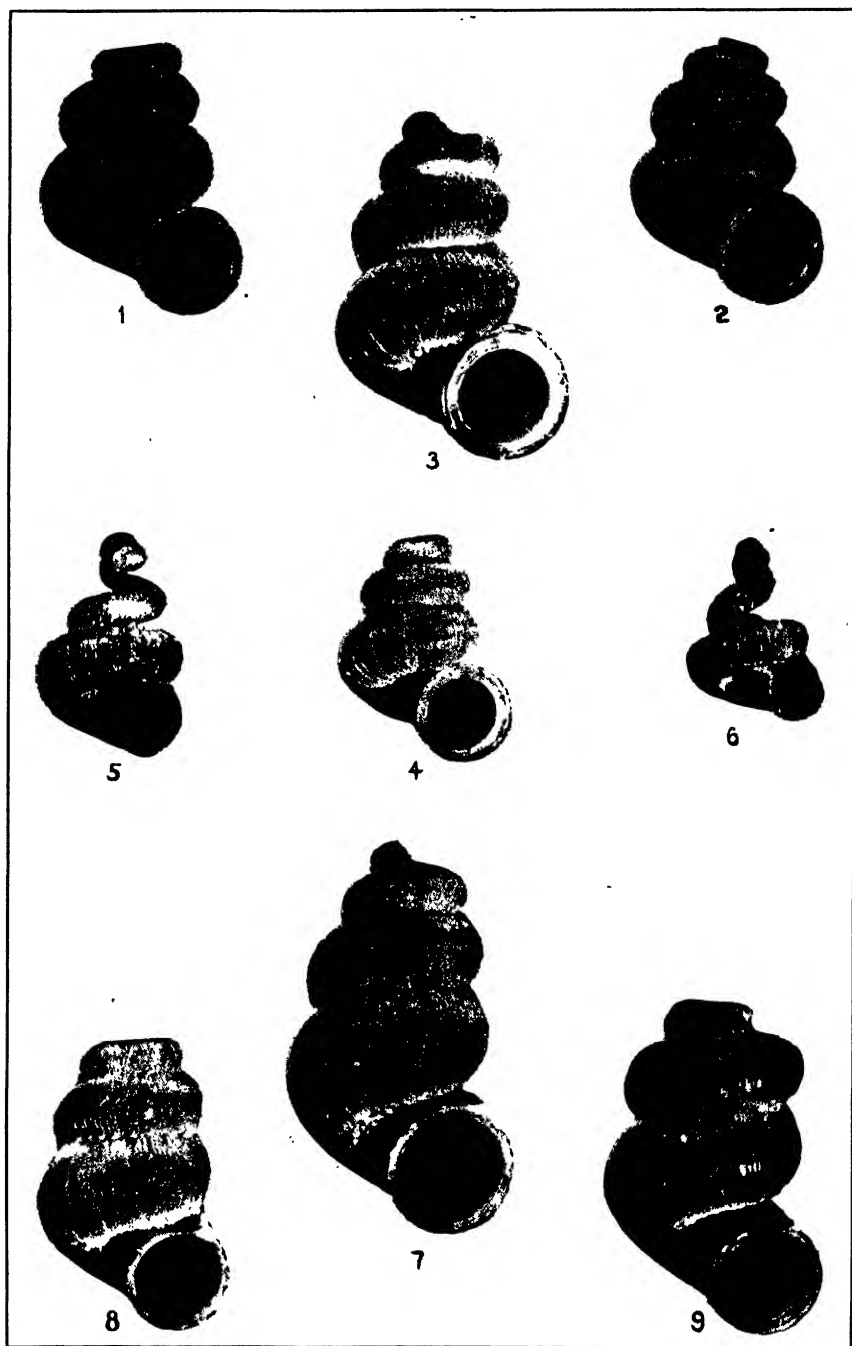
SPECIES AND SUBSPECIES OF LIMADORA, LIMADOREX, AND TUDORA.

- 1, *Limadora tollini*; 2, *L. garciana villaensis*; 3, *L. scabrata*; 4, *L. tollini* (nucleus much enlarged); 5, *L. garciana garciana*; 6, *Limadorex limonensis*; 7, *L. limonensis* (nuclear whorls much enlarged); 8, *Tudora* (*Eutudora*) *torquata*; 9, *T. (E.) torquata* (paratype). Figs. 1-6, $\times 4$; figs. 8, 9, $\times 8$.



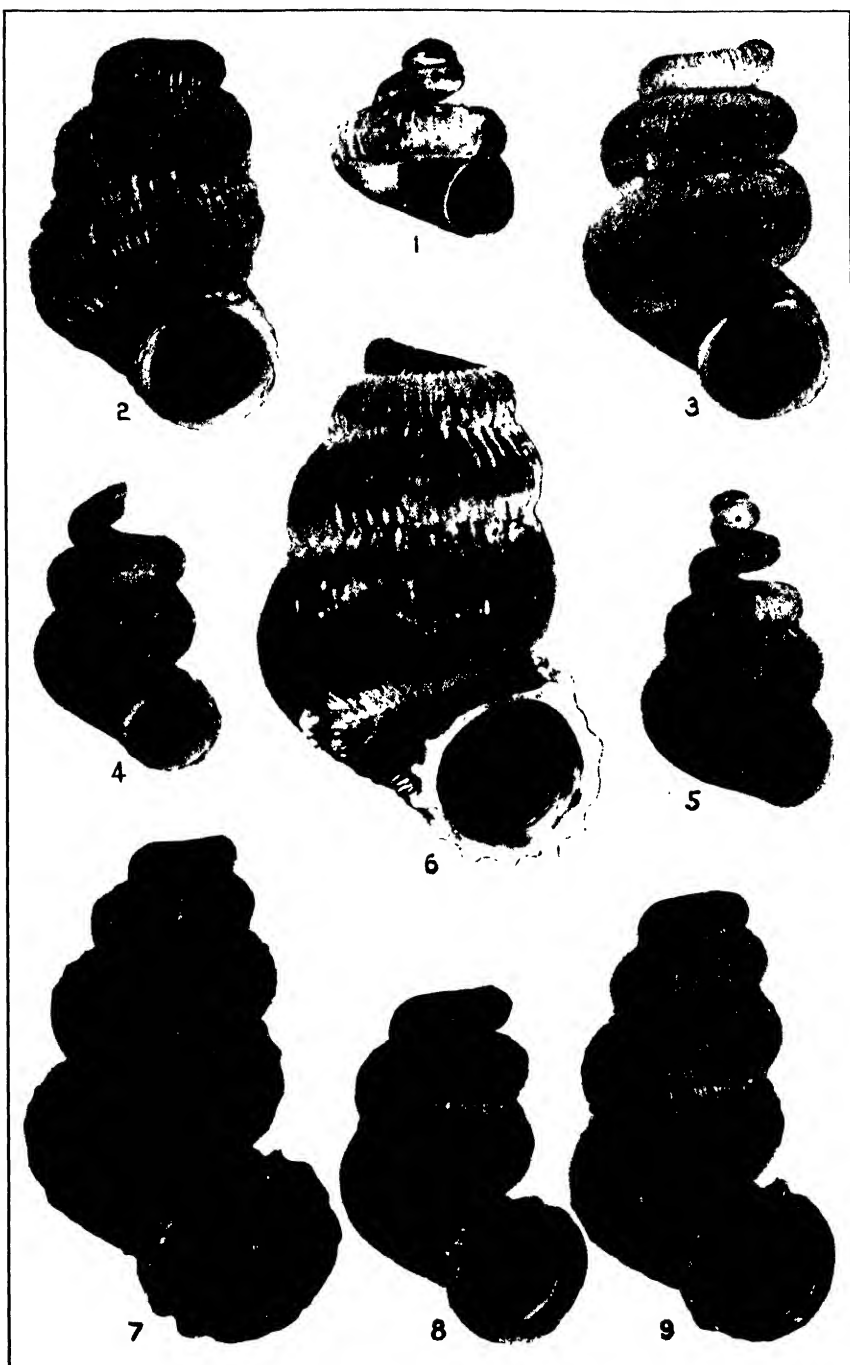
SPECIES AND SUBSPECIES OF TUDORA (EUTUDOREX) (X 8)

1, *complanata*; 2, *rotundata*; 3, *rocai*; 4, *undosa undosa*; 5, *puiserulenta*; 6, *welchi*; 7, *undosa barroi*; 8, *undosa laureani*.



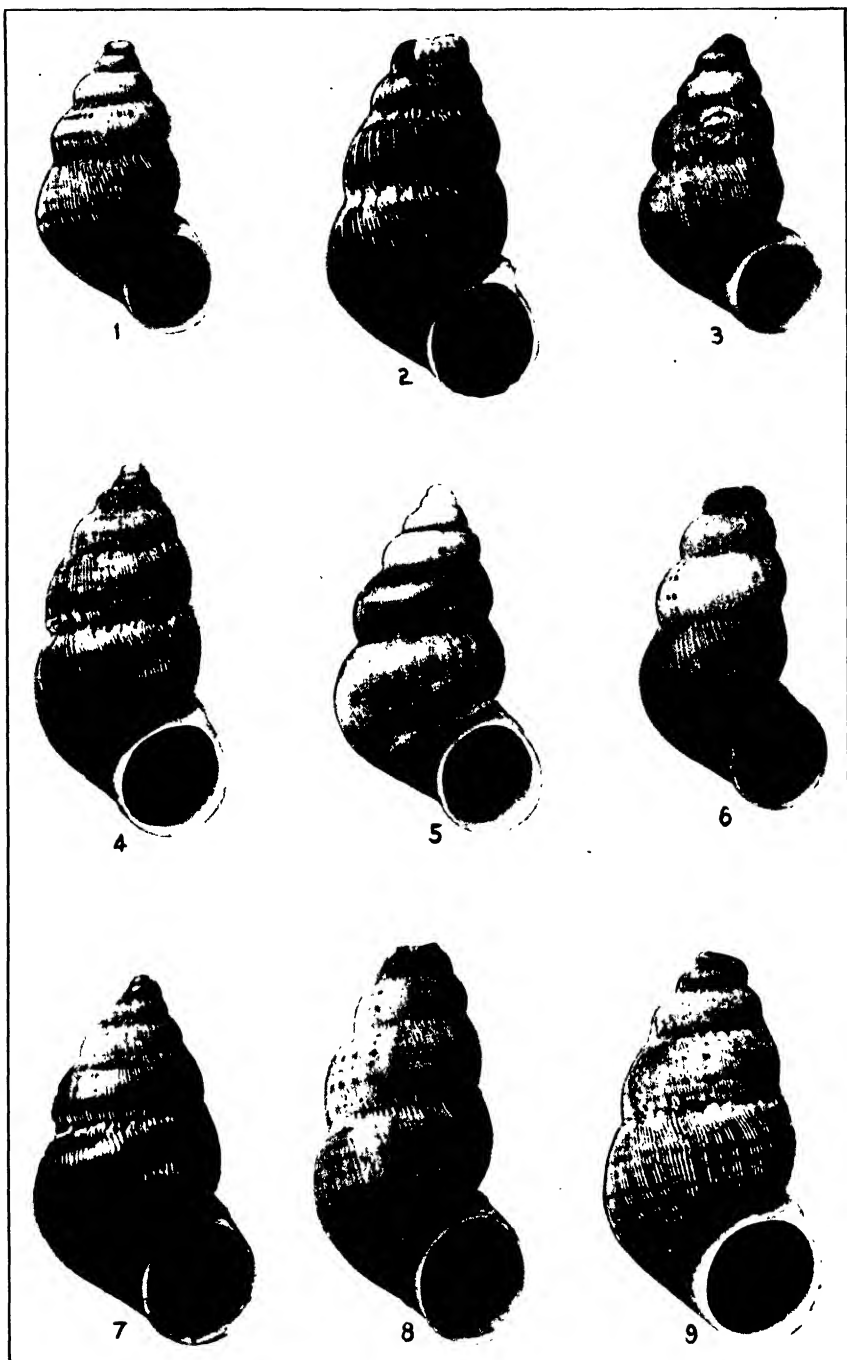
SPECIES AND SUBSPECIES OF TUDORA (X 8).

- 1, *Tudora* (*Eutudorex*) *trocheli antoniensis*; 2, *T. (E.) t. palmaritensis*; 3, *T. (E.) t. trocheli*; 4, *T. (E.) t. azucaren-*
sis; 5, *T. (Ramdenia) nobilitata nobilitata* (nucleus); 6, *T. (R.) n. mirifica* (nucleus); 7, *T. (R.) n. mirandensis*;
 8, *T. (R.) n. nobilitata*; 9, *T. (R.) n. mirifica*.



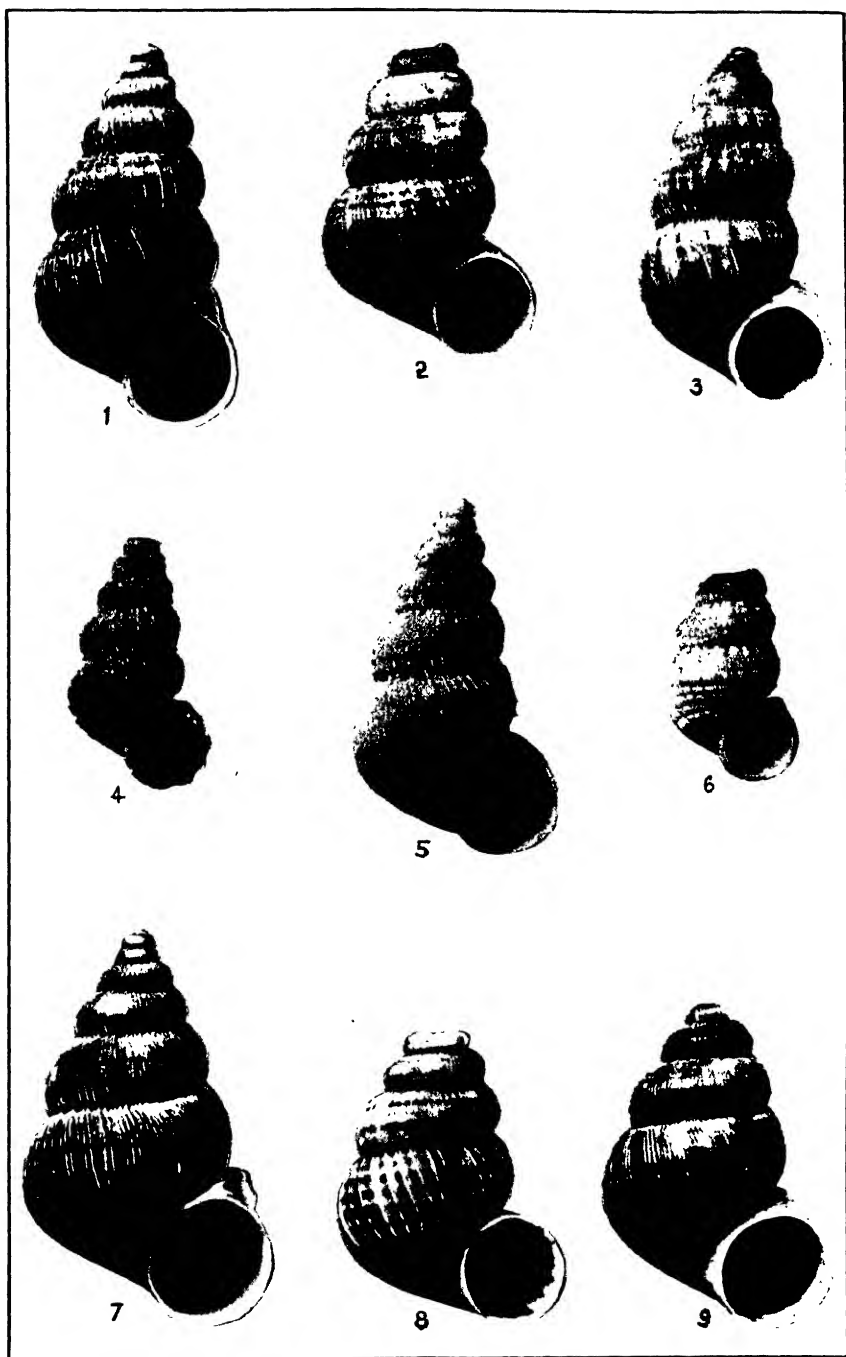
SPECIES AND SUBSPECIES OF TUDORA (RAMSDENIA) (X 8).

- 1, *perspectiva* (nucleus); 2, *bufo*; 3, *nobilitata mayariensis*; 4, *nobilitata yateravensis*; 5, *notata* (nucleus); 6, *perspectiva*; 7, *natensoni canetensis*; 8, *notata*; 9, *natensoni natensoni*.



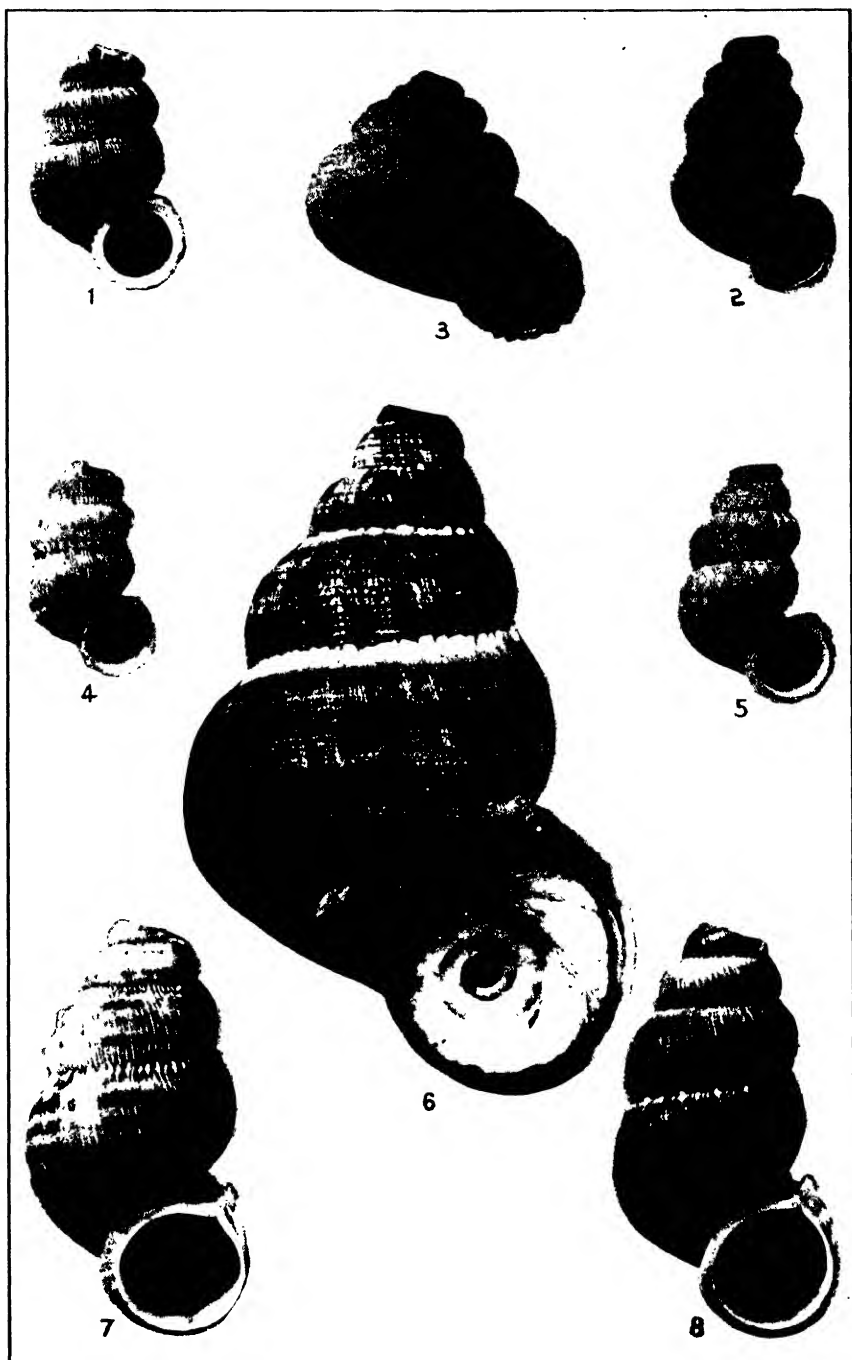
SPECIES AND SUBSPECIES OF TUDORA (AGUAYOTUDORA) (X 8).

1, *recta martiensis*; 2, *recta barreti*; 3, *recta recta*; 4, *cristata cristata*; 5, *suavis*; 6, *cristata chorrillensis*; 7, *crassiuscula*;
8, *bermudezi bermudezi*, 9, *bermudezi sibanicuensis*.



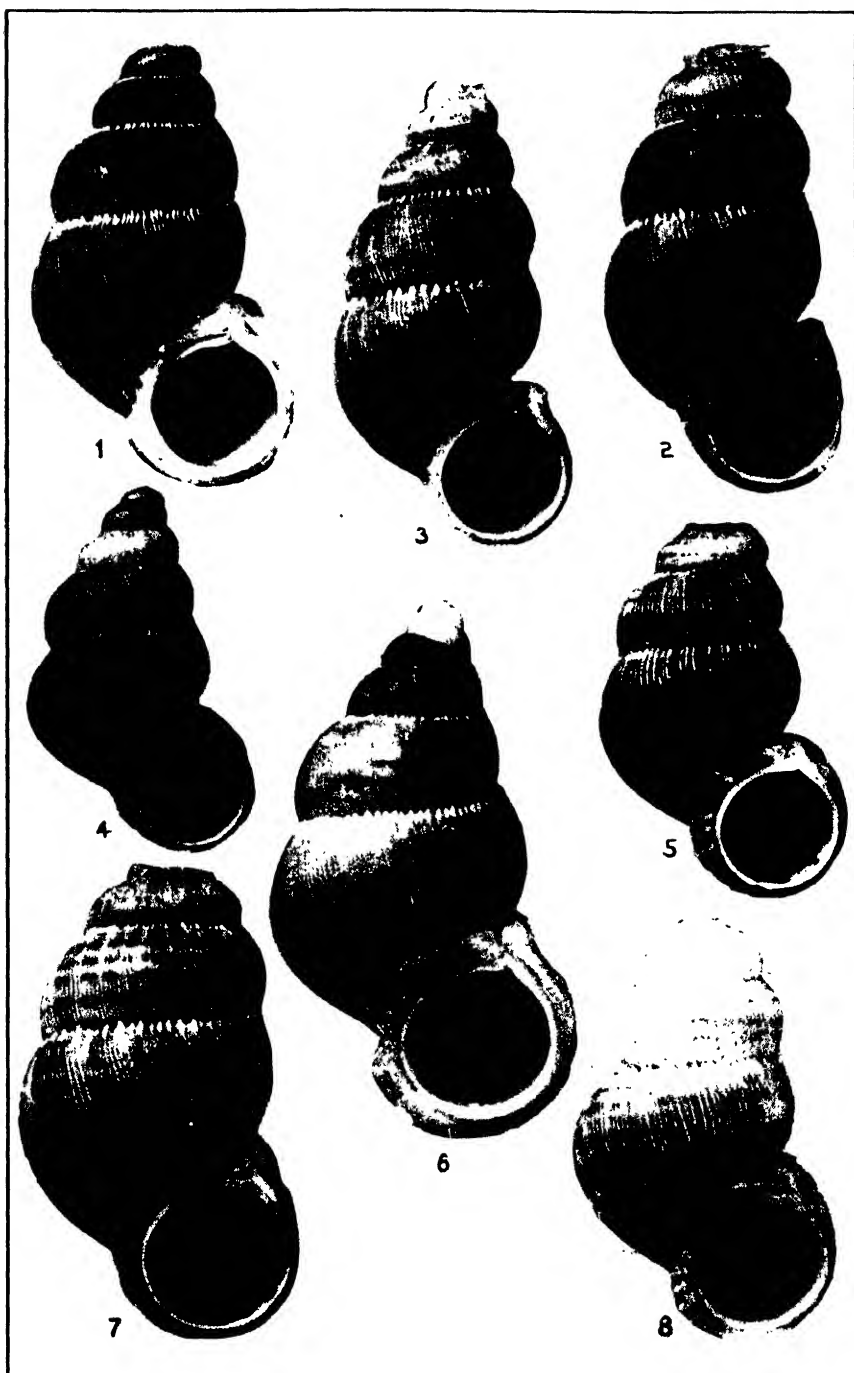
SPECIES AND SUBSPECIES OF TUDORA (X 4).

Tudora (*Aguayotudora*) *aguayoi guascanamarensis*; 2, *T. (A.) tuberculata*; 3, *T. (A.) aguayoi najazarenis*; 4, *T. (Hrightudora) arcticoronata*; 5, *T. (A.) asperata*; 6, *T. (H.) enode*; 7, *T. (A.) aguayoi aguayoi*; 8, *T. (A.) varicosa*; 9, *T. (A.) obesa*.



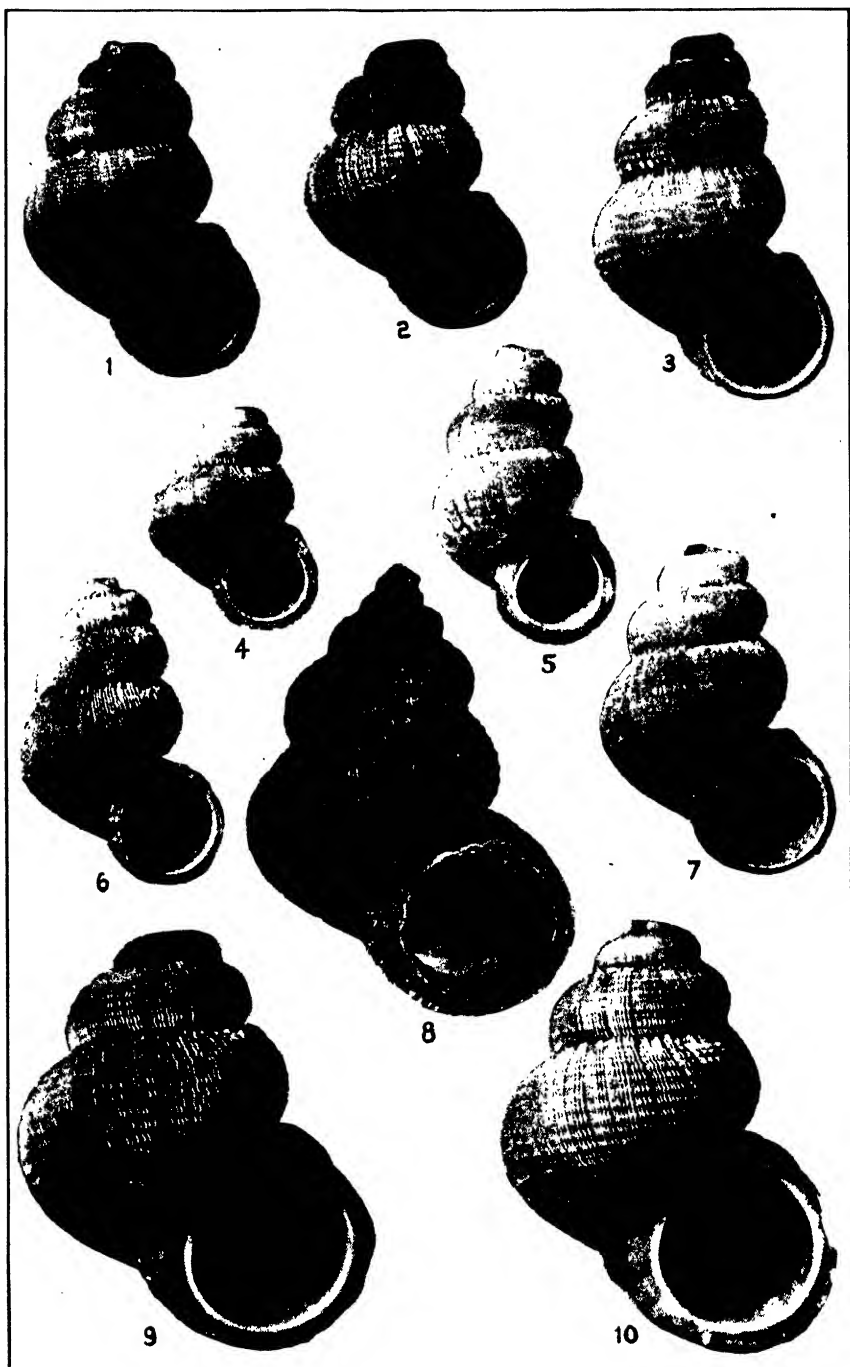
SPECIES AND SUBSPECIES OF TUDORA AND ANNULARIA (X 4).

- 1, *Tudora* (*Wrightstudora*) *gundlachi*; 2, *T.* (*W.*) *garridoiana garridoiana*; 3, *T.* (*Gundlachstudora*) *decolorata*; 4, *T.* (*W.*) *semicoronata*; 5, *T.* (*W.*) *garridoiana baracoensis*; 6, *T.* (*Tudorina*) *rangelina*; 7, *Annularia* (*Annularodea*) *uncinata*; 8, *A.* (*A.*) *canaensis*.



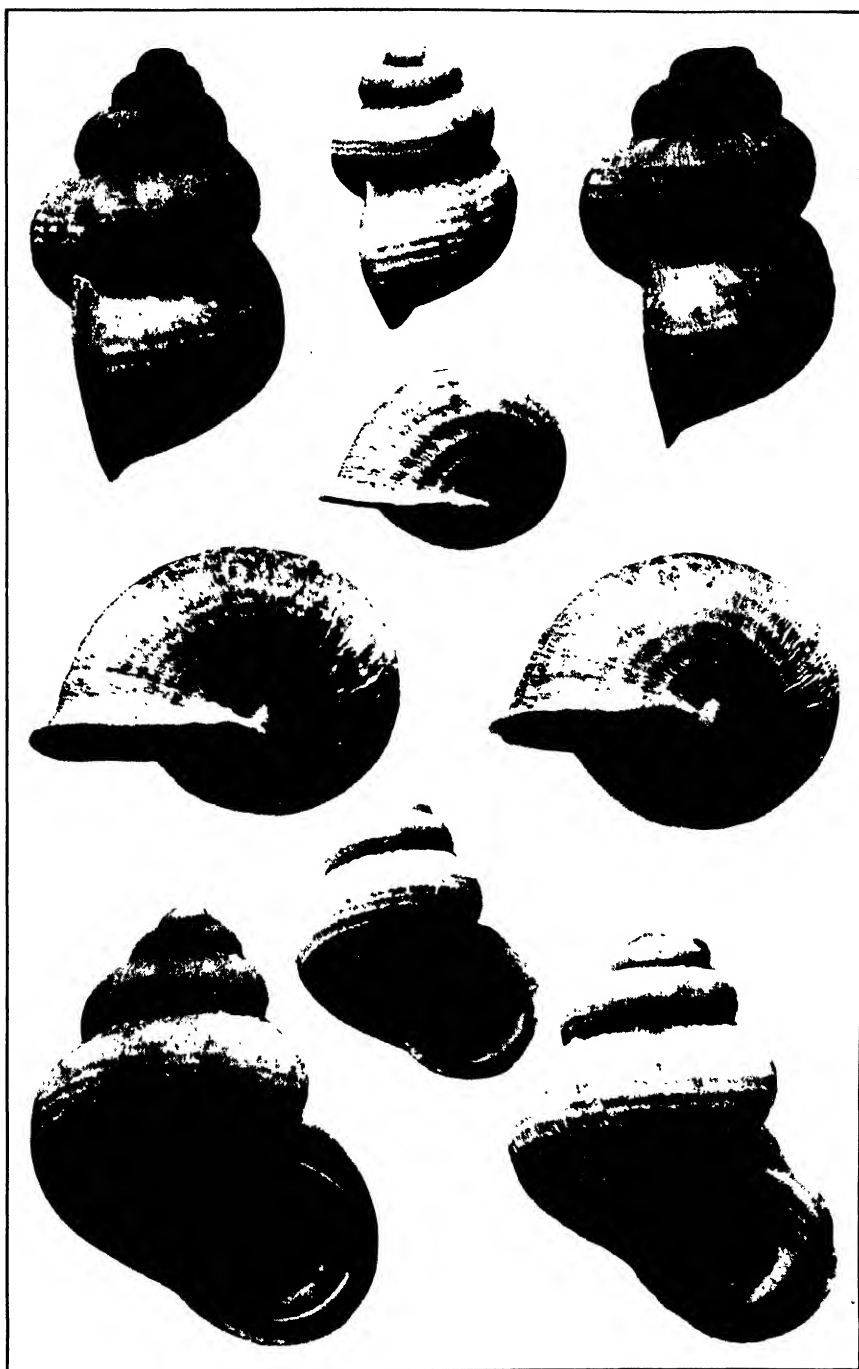
SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

- 1, *A. (Annularodisca) pilobryi*; 2, *A. (Annularodes) terneroensis terneroensis*; 3, *A. (A.) indiea*; 4, *A. (A.) can tarillensis*; 5, *A. (A.) terneroensis indioensis*; 6, *A. (A.) obsoleta*; 7, *A. (A.) perezii perezii*; 8, *A. (A.) p. gutarti*.



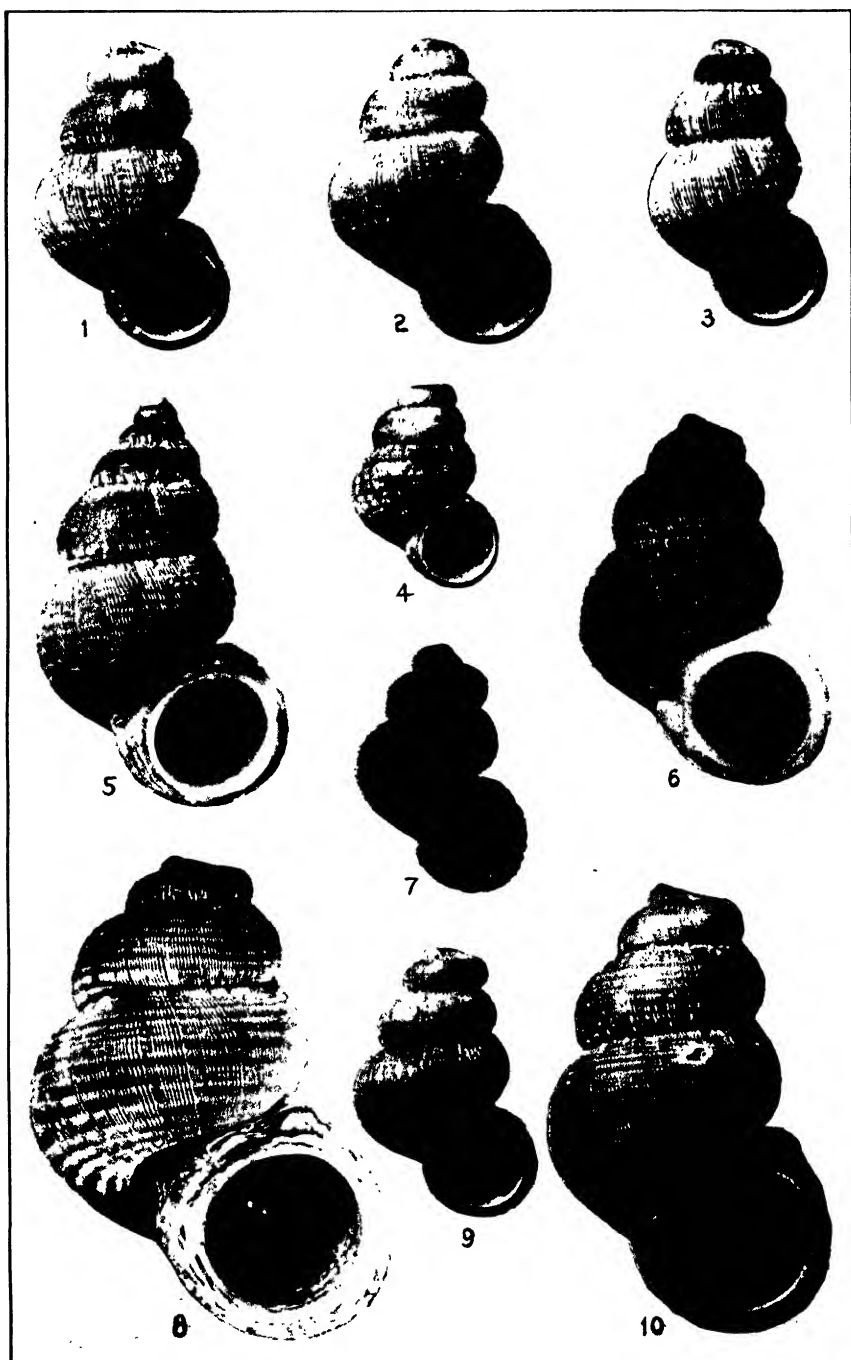
SPECIES AND SUBSPECIES OF ANNULARIA (ANNULAROPS) (X 4).

1, *sauvallei chorrerensis*; 2, *semicana nana*; 3, *sauvallei natensoni*; 4, *perplexa*; 5, *vannostrandii*; 6, *sauvallei cortinaei*;
7, *sauvallei sauvallei*; 8, *plicata*; 9, *semicana organicola*; 10, *semicana semicana*.



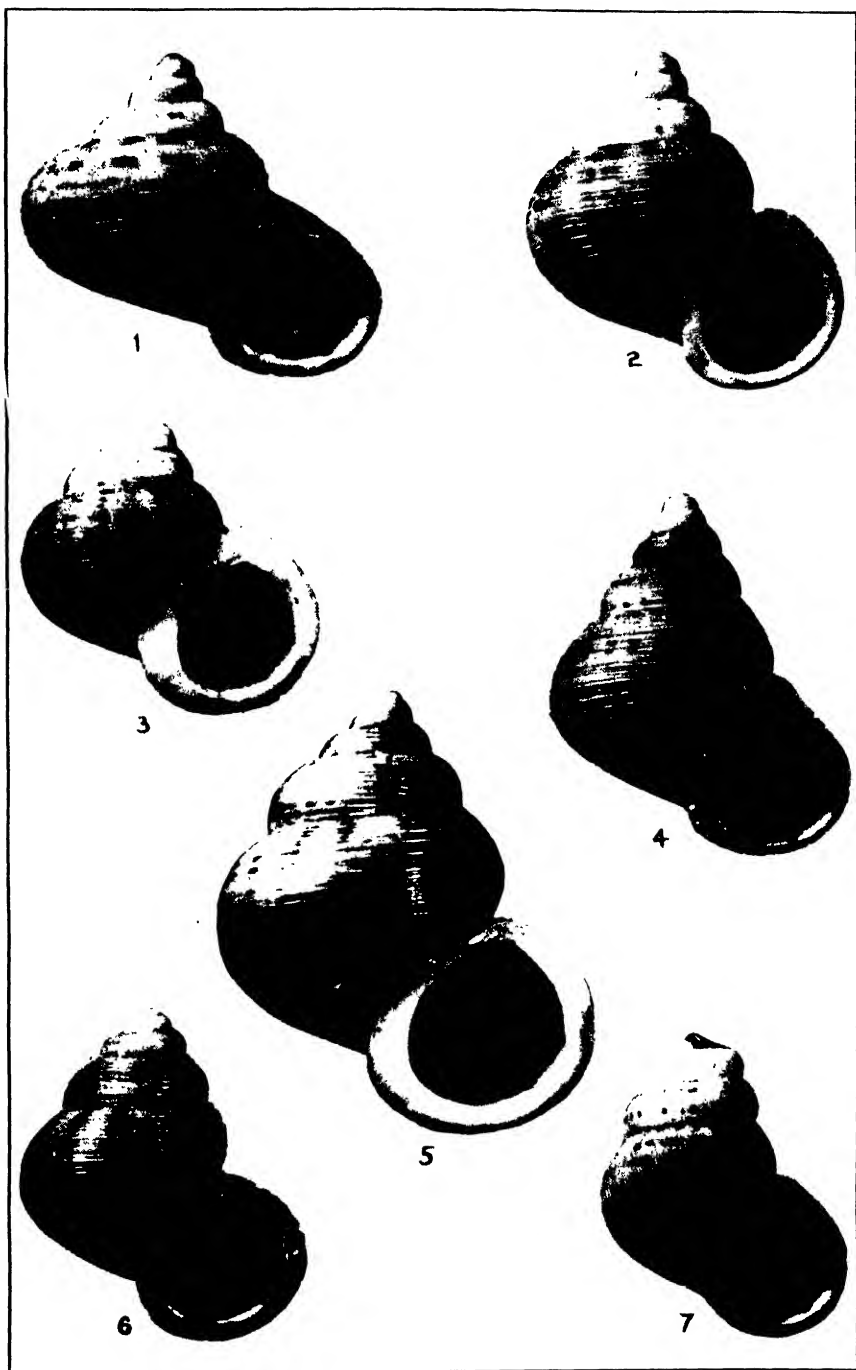
ANNULARIA (ANNULAROPS) SEMICANA SEMICANA (X 4).

The three cotypes in the British Museum.



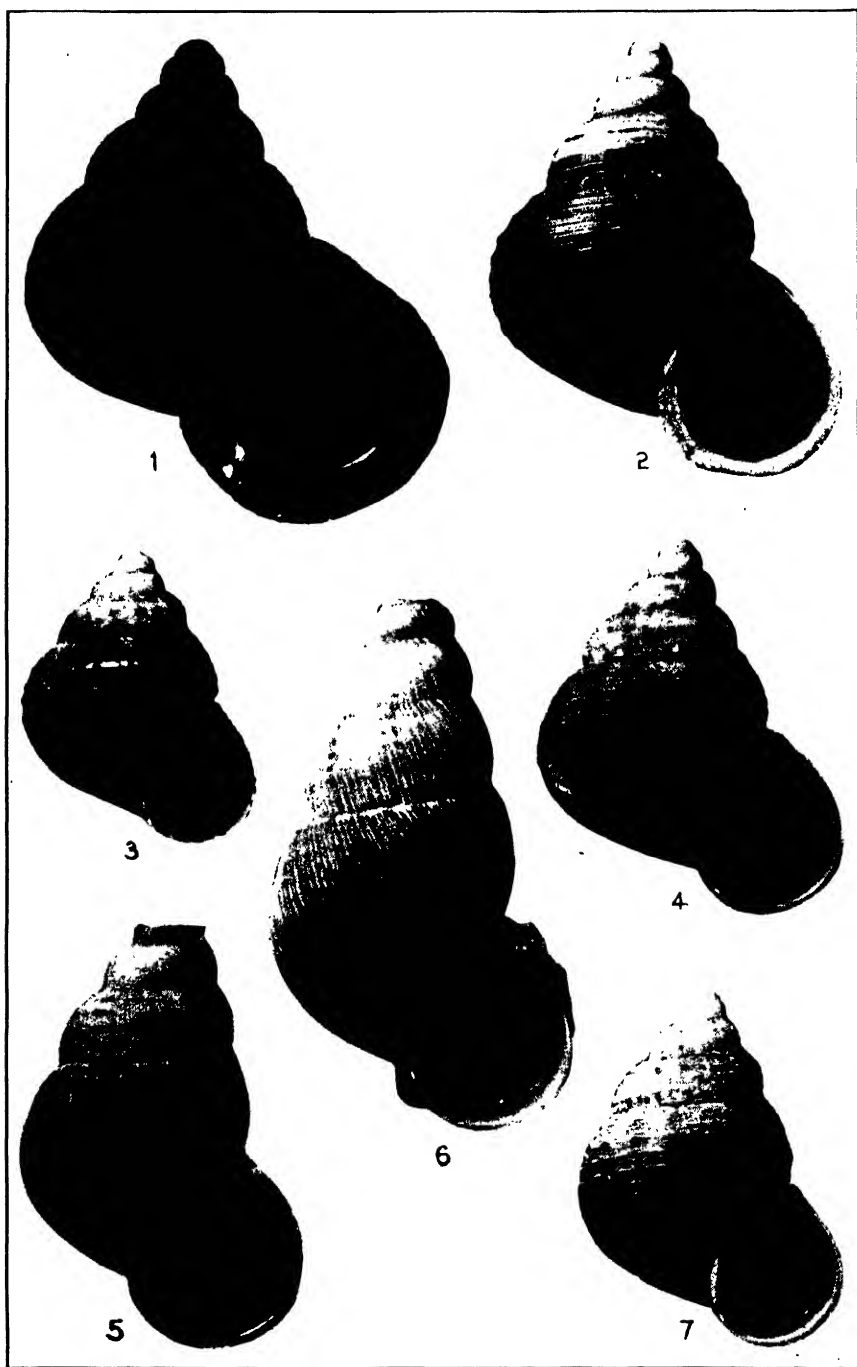
SPECIES AND SUBSPECIES OF ANNULARIA (ANNULAROPS) (X 4).

- 1, *coronados spurca*; 2, *blaini cumbrensis*; 3, *coronados acervata*; 4, *coronados coronados*; 5, *attenuata attenuata*; 6, *attenuata morsei*; 7, *tryoni vinalensis*; 8, *blaini blaini*; 9, *tryoni tryoni*; 10, *attenuata minnaensis*.



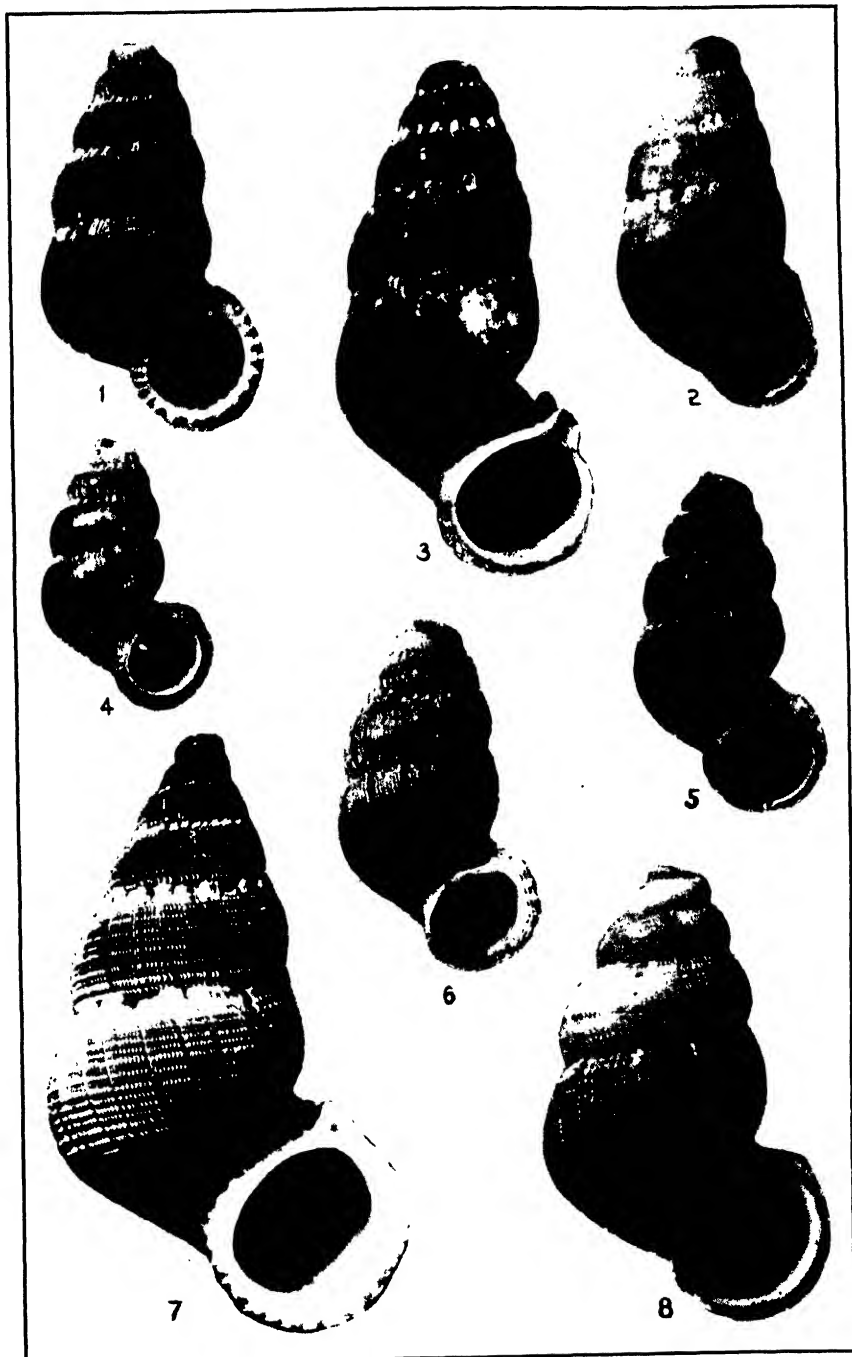
SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

- 1, *A. (Eutudora) cabrerai*; 2, *A. (E.) transitoria distincta*; 3, *A. (E.) latistoma*; 4, *A. (E.) transitoria transitoria*;
5, *A. (E.) limbifera ternata*; 6, *A. (E.) limbifera limbifera*; 7, *A. (Annularodella) morenoi*.



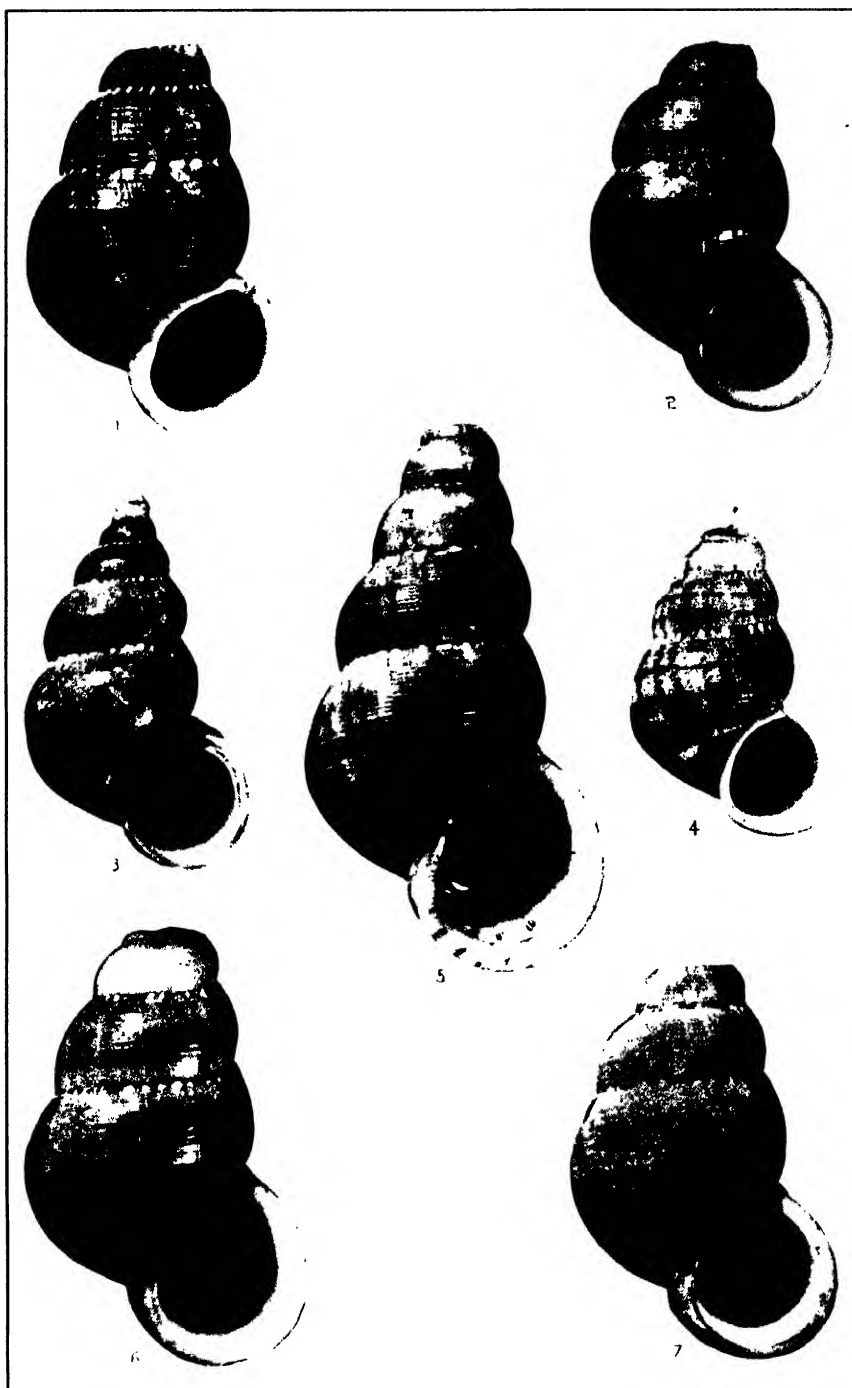
SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

- 1, *A. (Eutudoriscia) jimenoi*; 2, *A. (E.) camoensis*; 3, *A. (E.) catenata blanesi*; 4, *A. (E.) agassizi*; 5, *A. (Focularia) inquisti*; 6, *A. (F.) boqueronensis*; 7, *A. (Eutudoriscia) catenata catenata*.



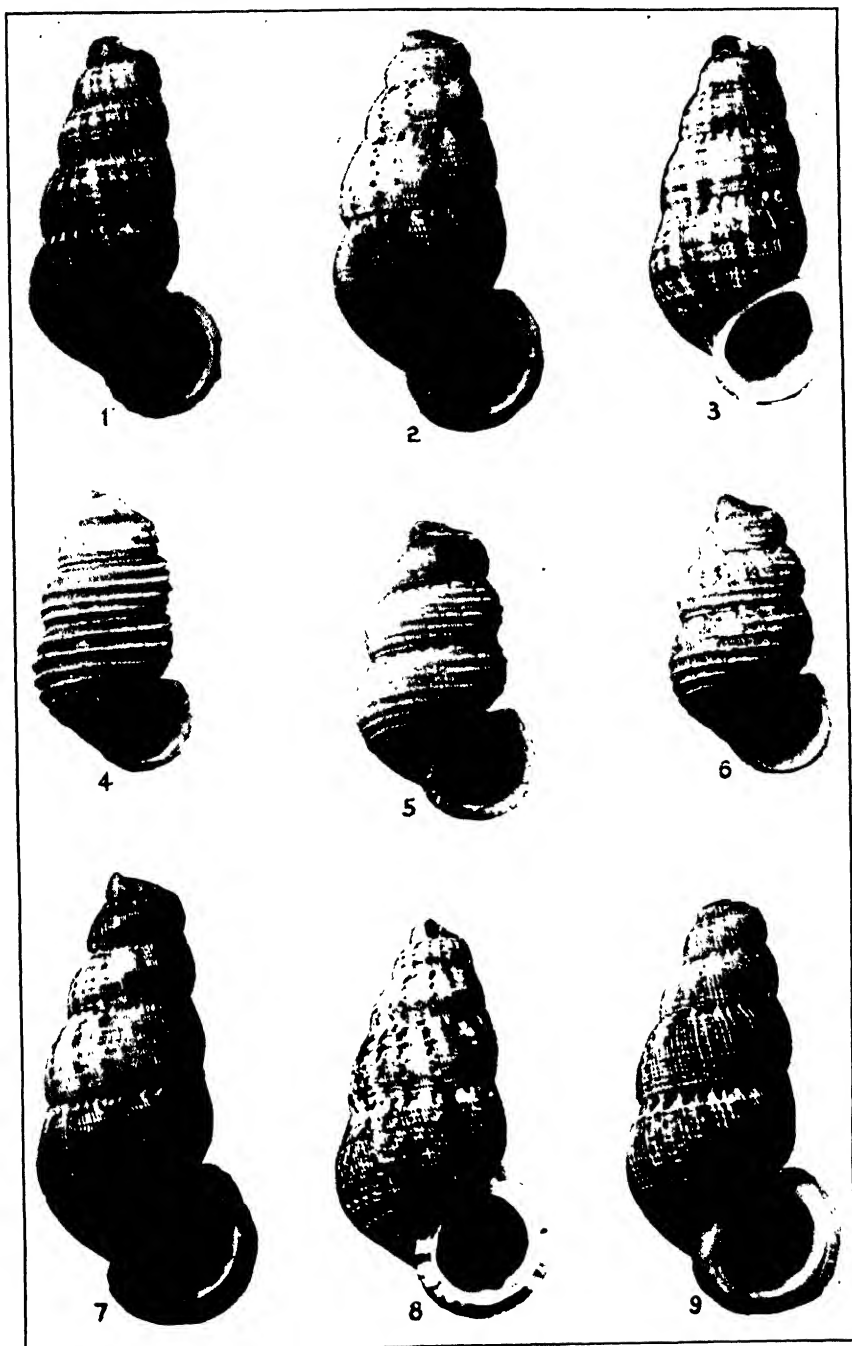
SPECIES AND SUBSPECIES OF ANNULARIA (DIPLOPOMA) (X 4).

1, *torrei*; 2, *architectonica tanamensis*; 3, *architectonica architectonica*; 4, *obsoleta*; 5, *ongoensis*; 6, *pilsbryi*;
7, *ramsdeni*; 8, *architectonica libanoensis*.



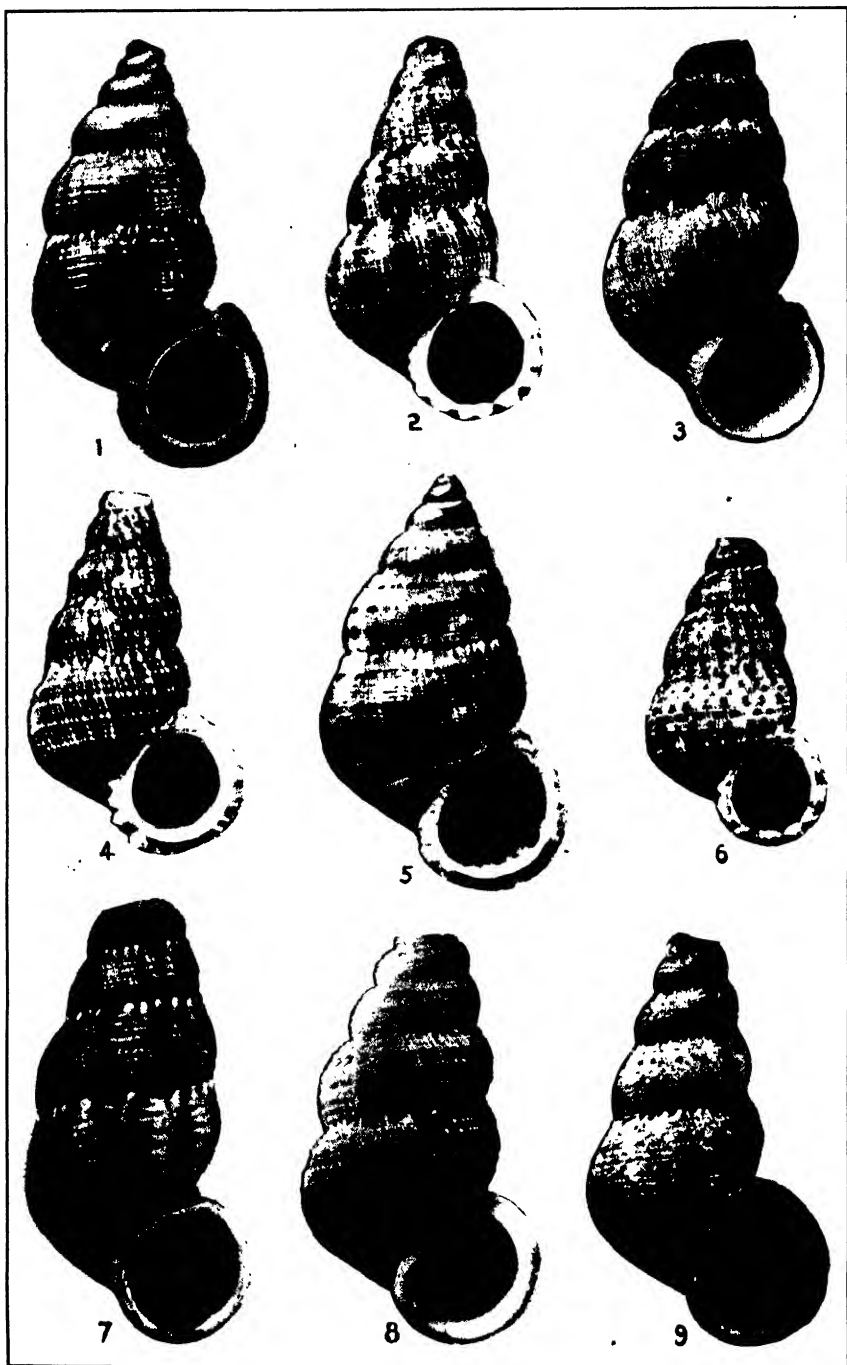
SUBSPECIES OF ANNULARIA (ANNULARITA) MAJUSCULA (X 2).

1, *macta*; 2, *crassilabris*; 3, *narcisi*; 4, *catalinensis*; 5, *exceba*; 6, *majuscula*; 7, *cumbrensis*.



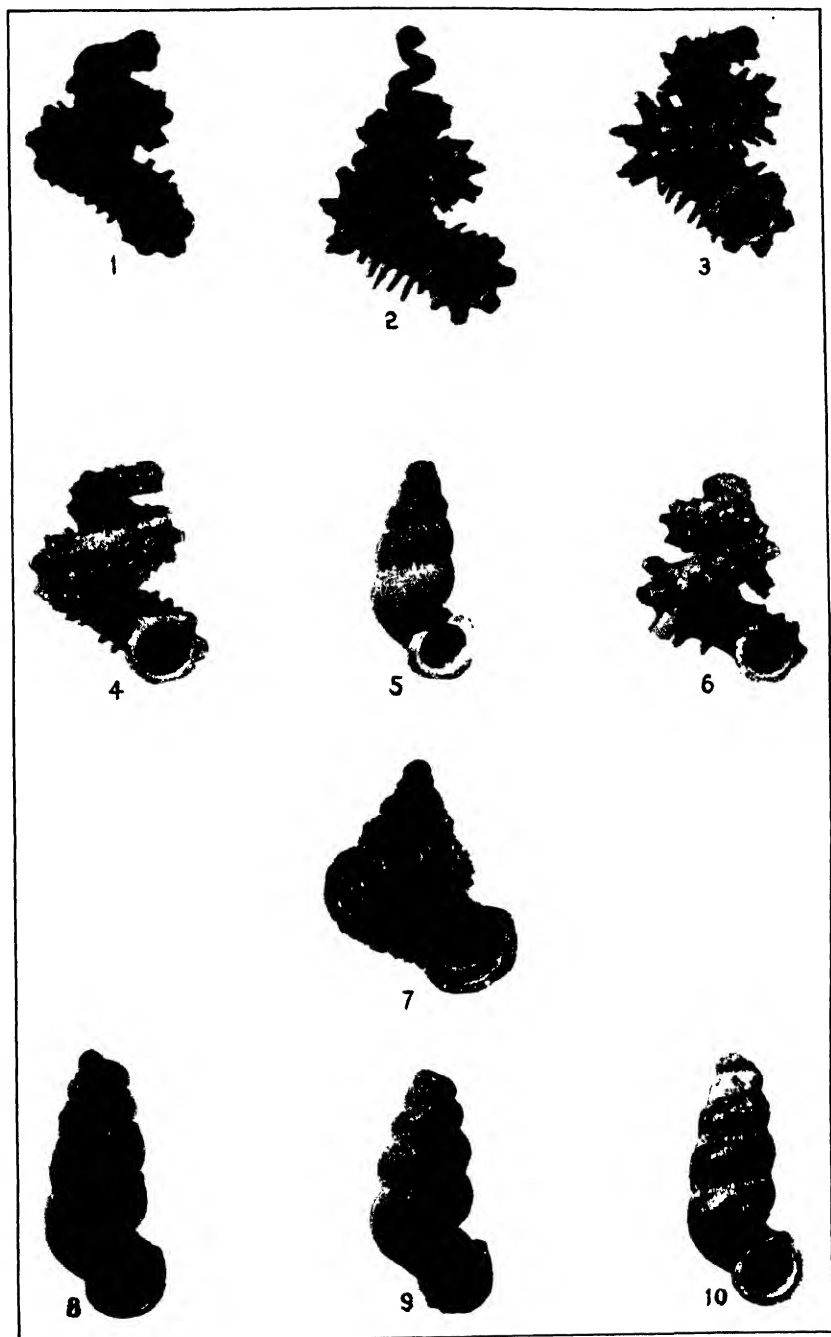
SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

- 1, *A. (Trochelvindex) candeana candeana*; 2, *A. (T.) jiguanaensis jiguanaensis*; 3, *A. (T.) candeana fallax*; 4, *A. (Juannularia) arguta arguta*; 5, *A. (J.) perplicata*; 6, *A. (J.) arguta insularis*; 7, *A. (T.) tracta*; 8, *A. (T.) jiguanaensis negrosensis*; 9, *A. (T.) j. bairensis*.



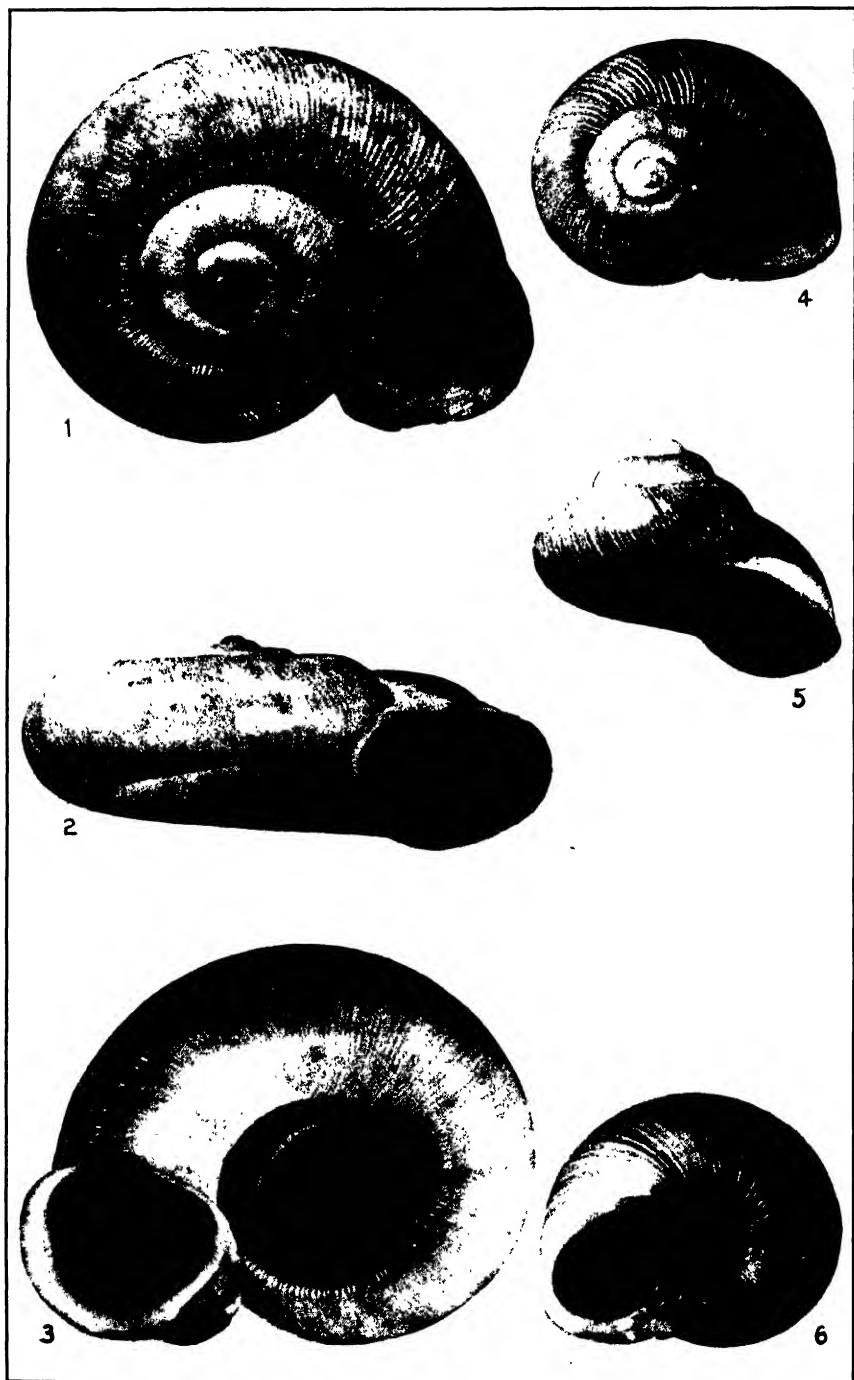
SPECIES AND SUBSPECIES OF ANNULARIA (TROSCHELVINDE) (X 4).

1, *minia*; 2, *arangiana cautoensis*; 3, *rocai*; 4, *arangiana magistra*; 5, *barbouri*; 6, *arangiana arangiana*; 7, *inculta*; 8, *agrestis*; 9, *bebini*.



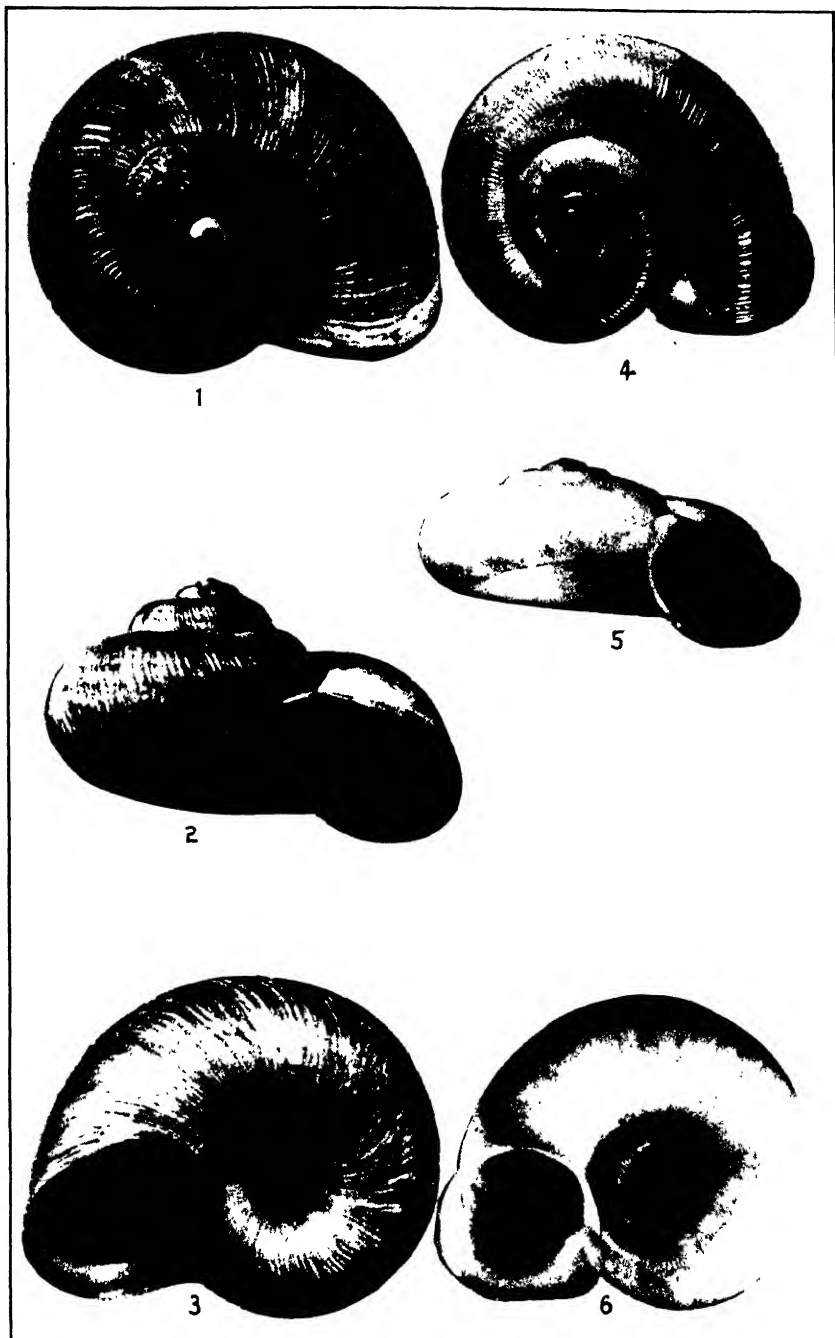
SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

- 1, 2, *A. (Blasospira) echinus echinus*; 3, *A. (B.) e. inthernalis*; 4, *A. (B.) e. lucifer*; 5, *A. (B.) rocai*; 6, *A. (Subannularia) jeannereti*; 7, *A. (Guajaibona) pretrei*; 8, *A. (S.) storchii nipensis*; 9, *A. (S.) lachneri*; 10, *A. (S.) storchii storchii*.



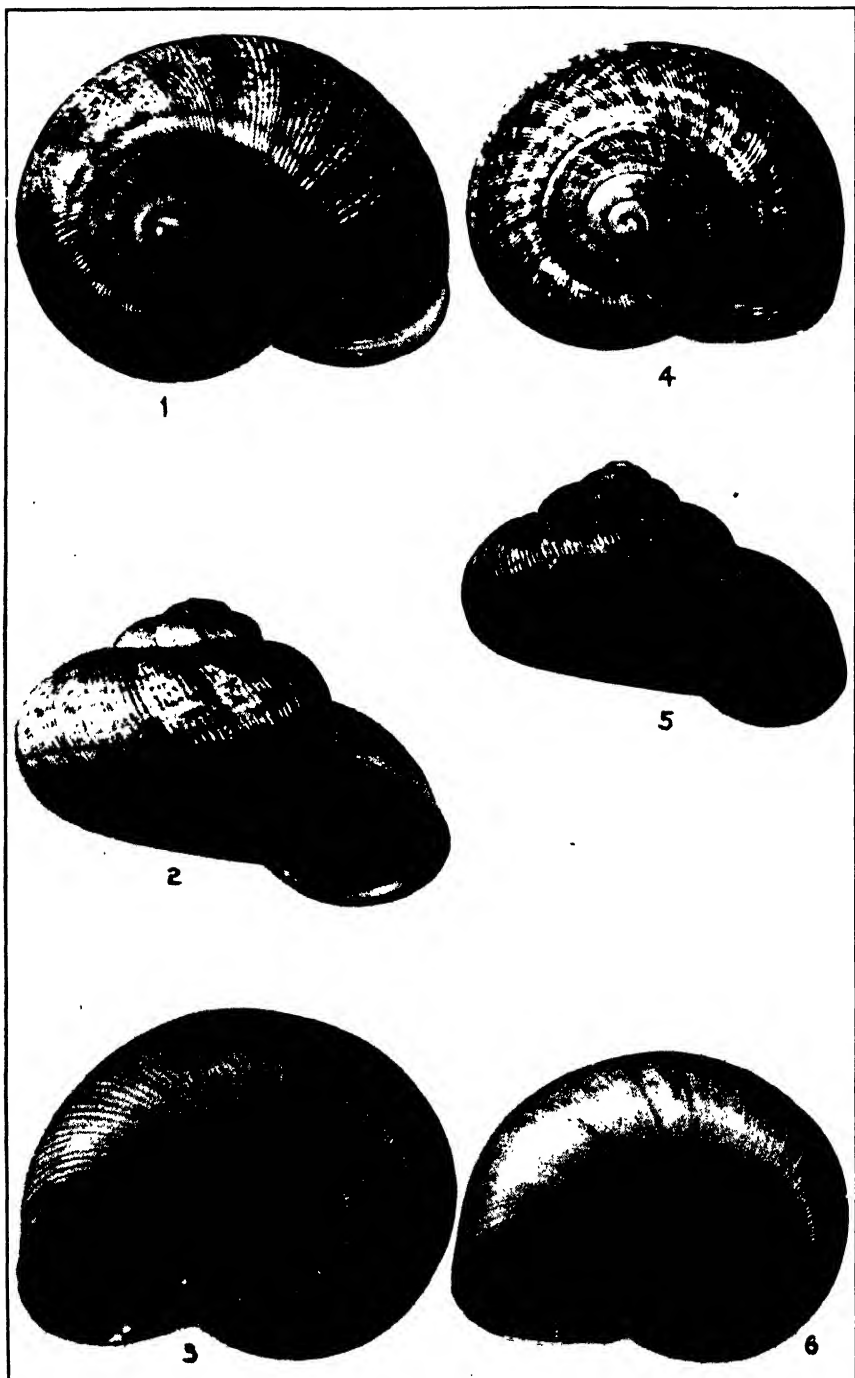
SPECIES OF ANNULARIA (ANNULARISCA) (X 4).

1 3, *prestoni*; 4 6, *tacrensis*.

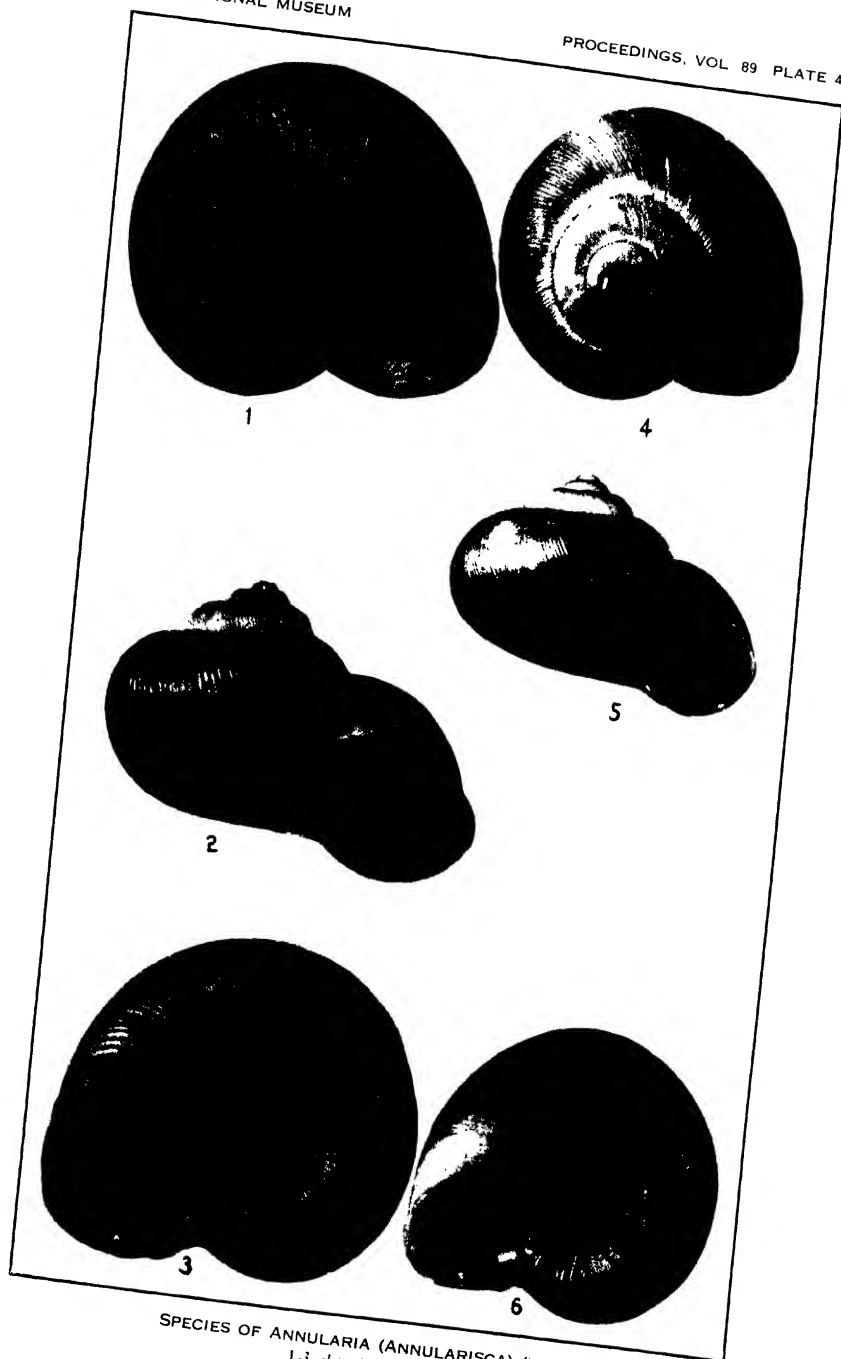


SPECIES OF ANNULARIA (ANNULARISCA) (X 4).

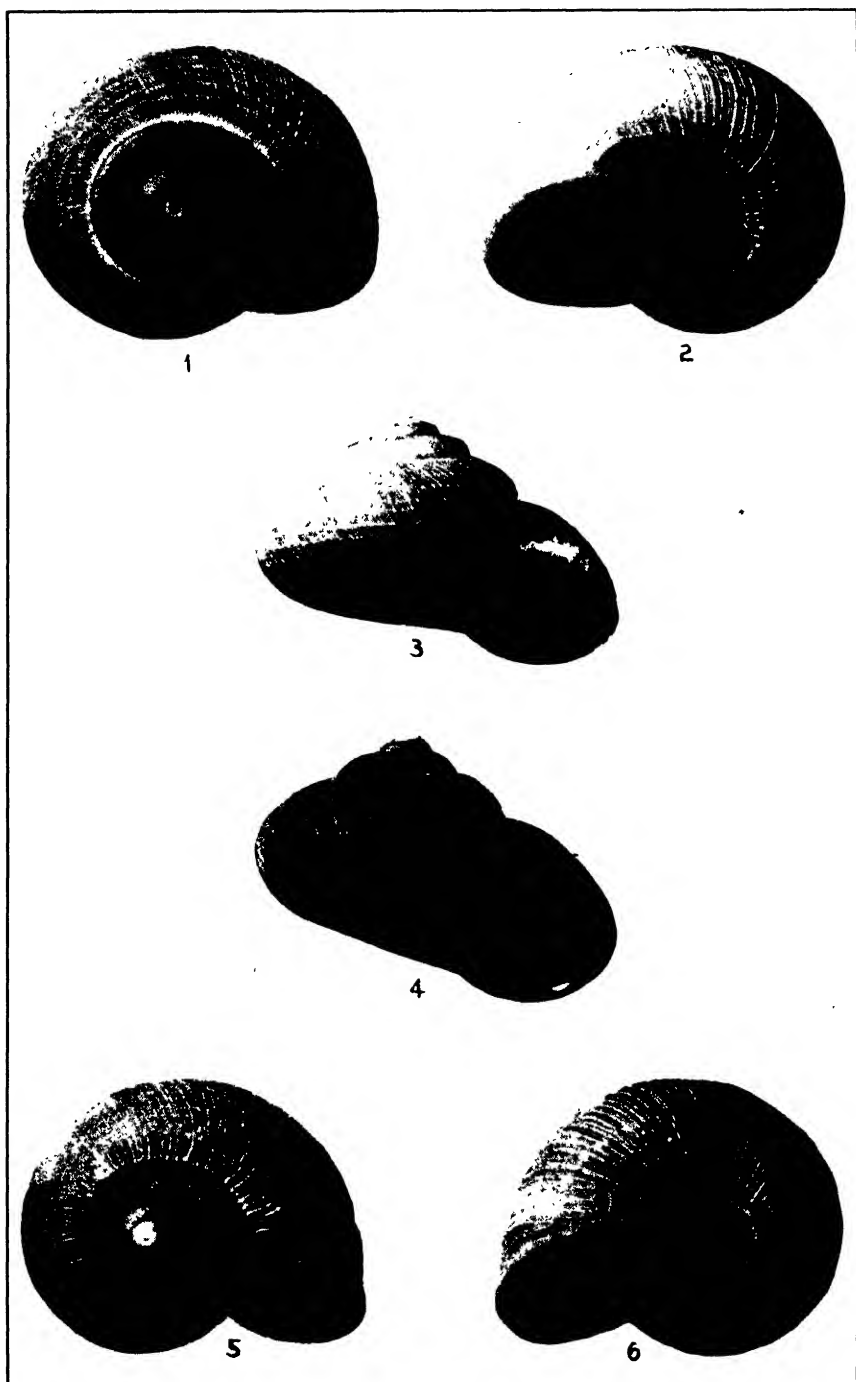
1-3, *aberrans*; 4-6, *eburnea*.



SUBSPECIES OF ANNULARIA (ANNULARISCA) AURICOMA ($\times 4$).
1-3, *putre*; 4-6, *auricoma*.

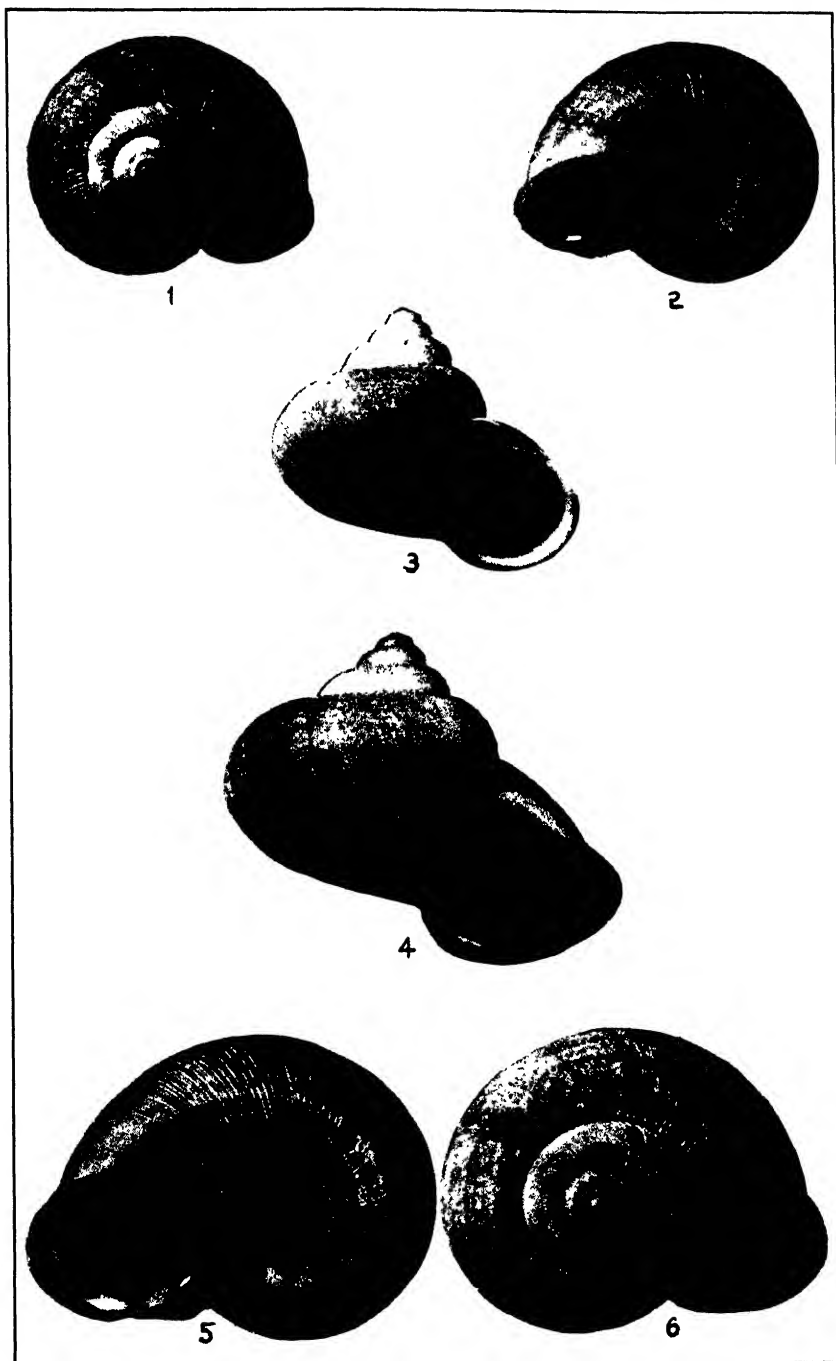


SPECIES OF ANNULARIA (ANNULARISCA) (X 4).
1-3, *alata*; 4-6, *pallens*.



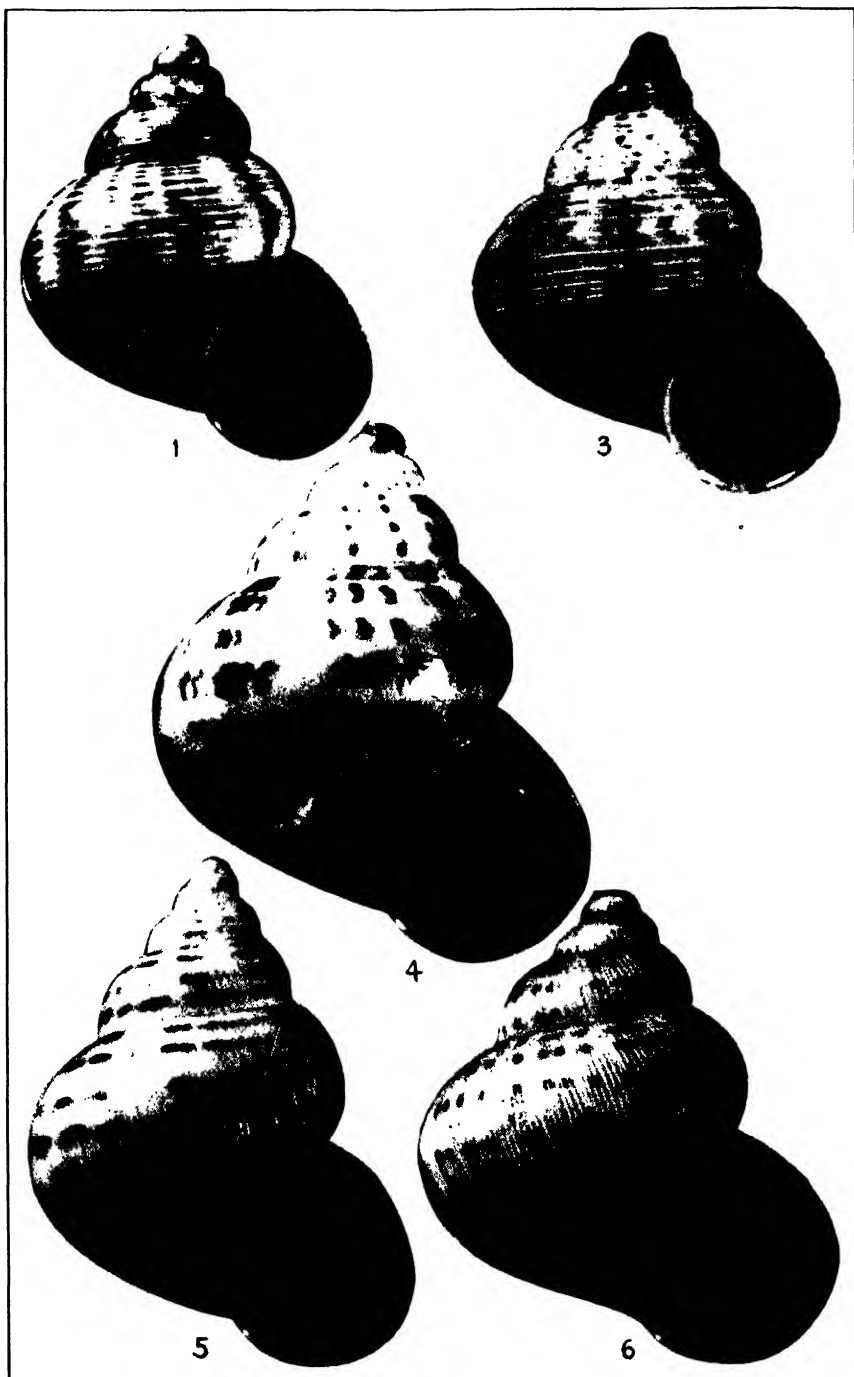
SPECIES OF ANNULARIA (ANNULAREX) (X 4).

1-3, *intercisa*; 4 6, *mackinlayi*.

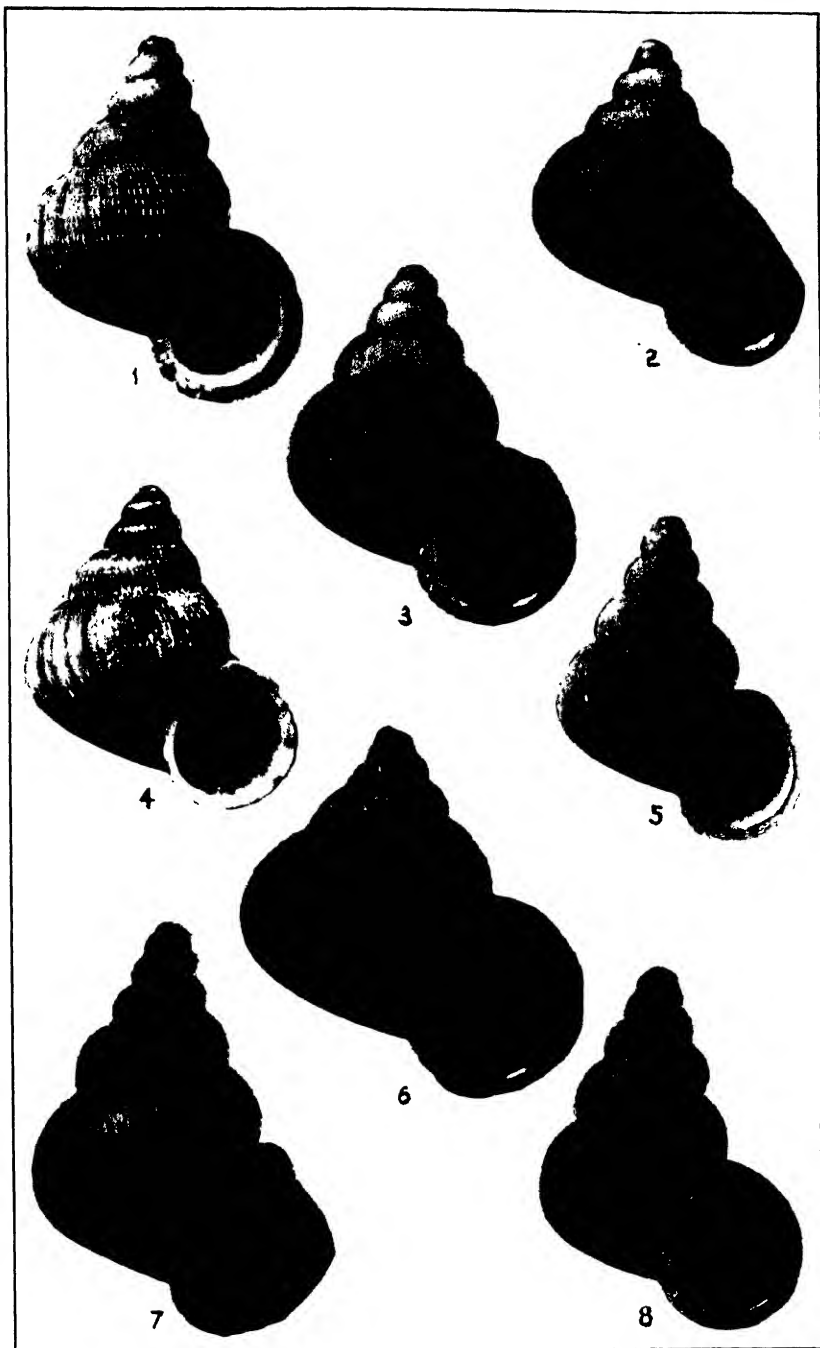


SPECIES OF ANNULARIA (ANNULAREX) (X 4).

1 3, *incerta*; 4 6, *ramsdeni*.

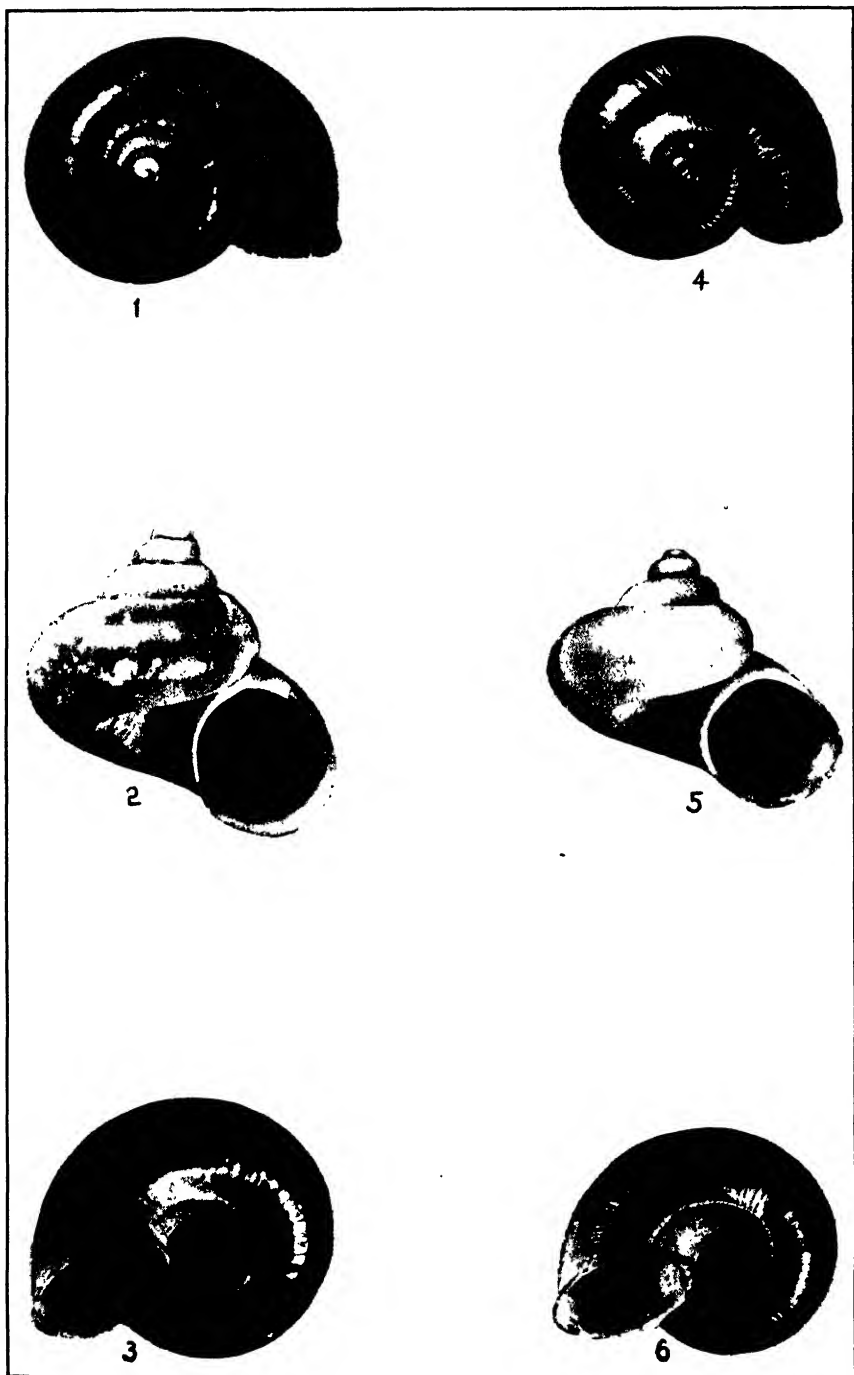


SPECIES OF ANNULARIA (BERMUDEZIA) ($\times 4$).
 1, *bermudezi*; 3, *payroli*; 4, *obliterata*; 5, *capestanvi*; 6, *euglypta*.



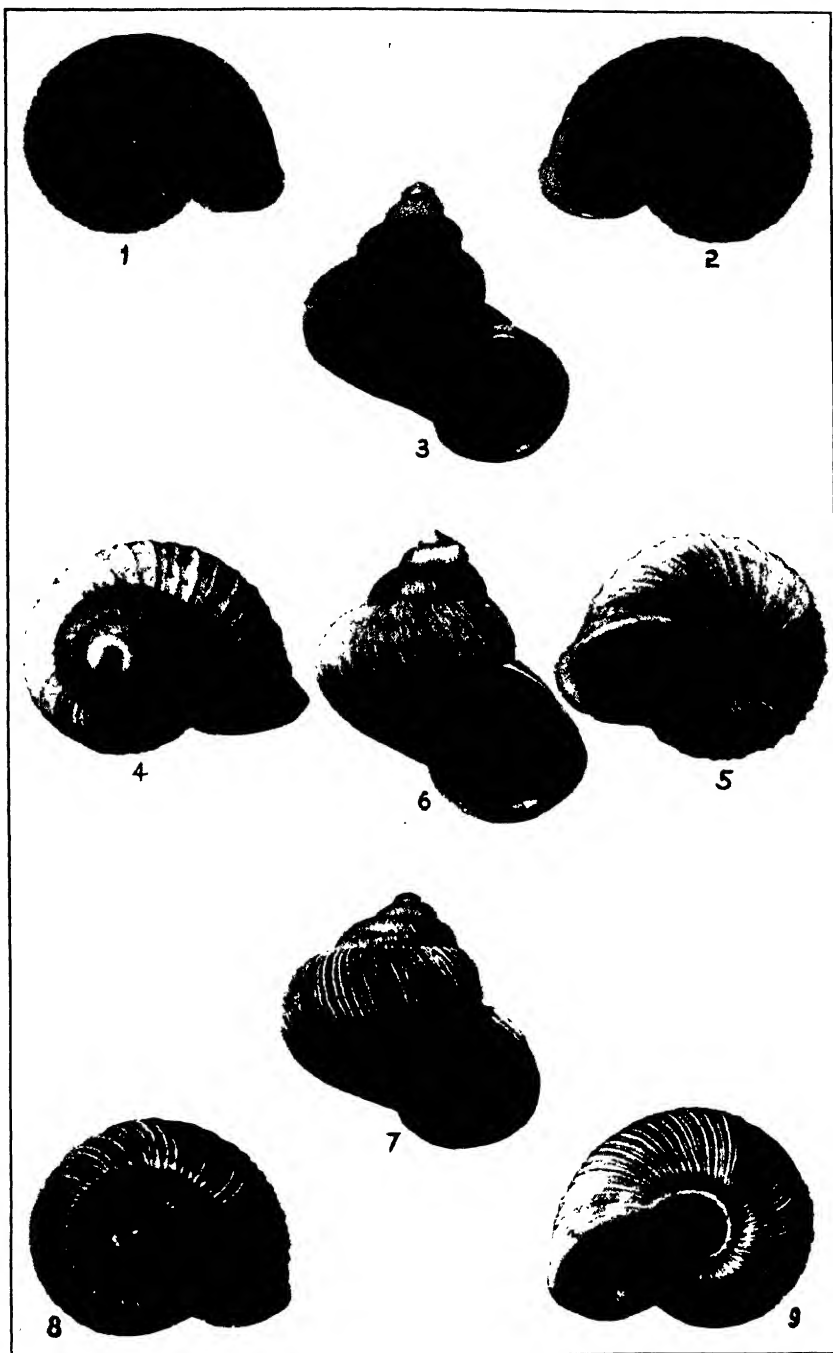
SPECIES AND SUBSPECIES OF ANNULARIA (LUGARENIA) (X 4).

- 1, *lirata lirata*; 2, *eurystoma chorrillensis*; 3, *biayensis*; 4, *sifontesi*; 5, *lirata parva*; 6, *eurystoma euryston*; 7, *najazaensis najazaensis*; 8, *najazaensis palomarensis*.

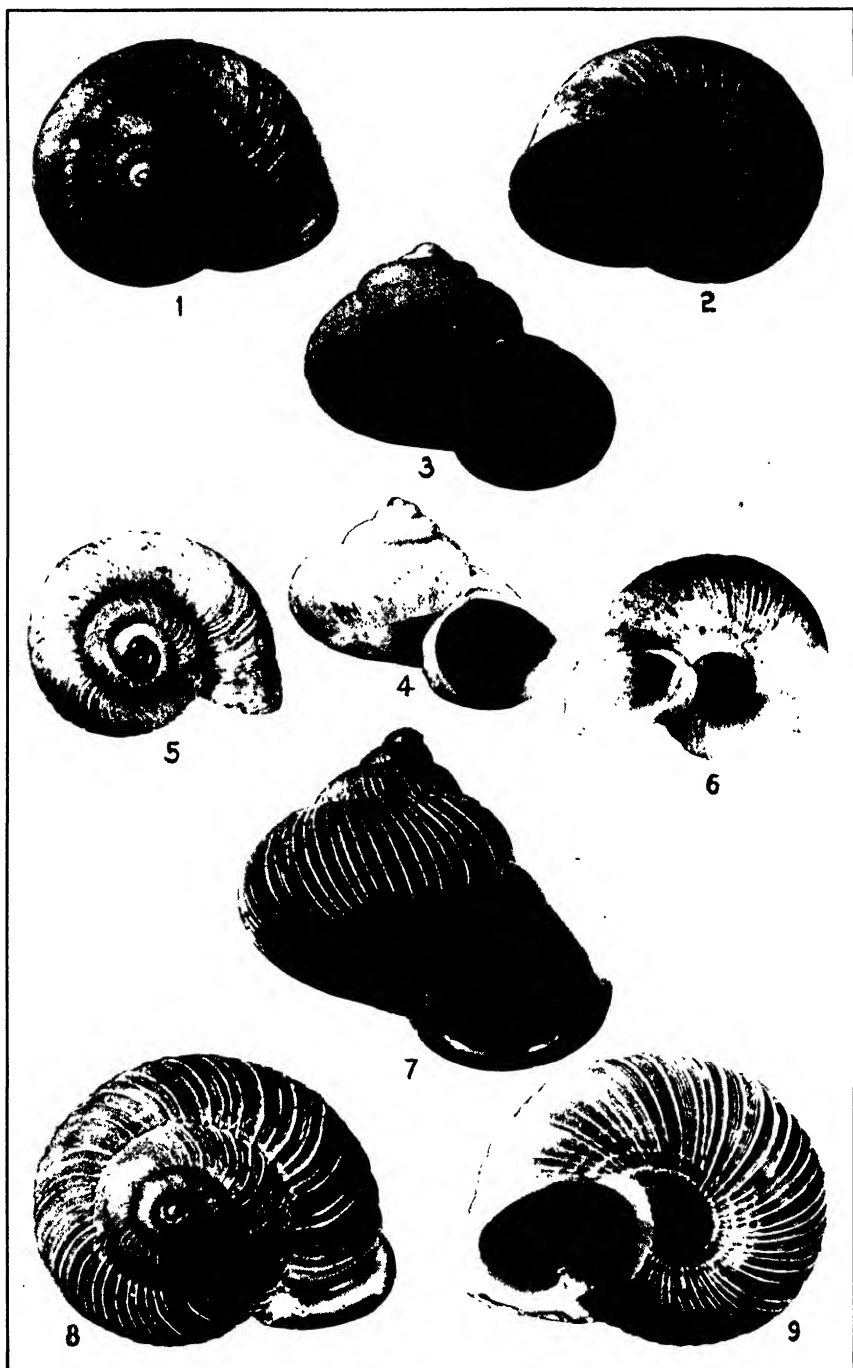


SUBSPECIES OF ANNULARIA (ANNULAROSA) FRAGILIS (X 4).

1-3, *fragilis*; 4-6, *juliani*.

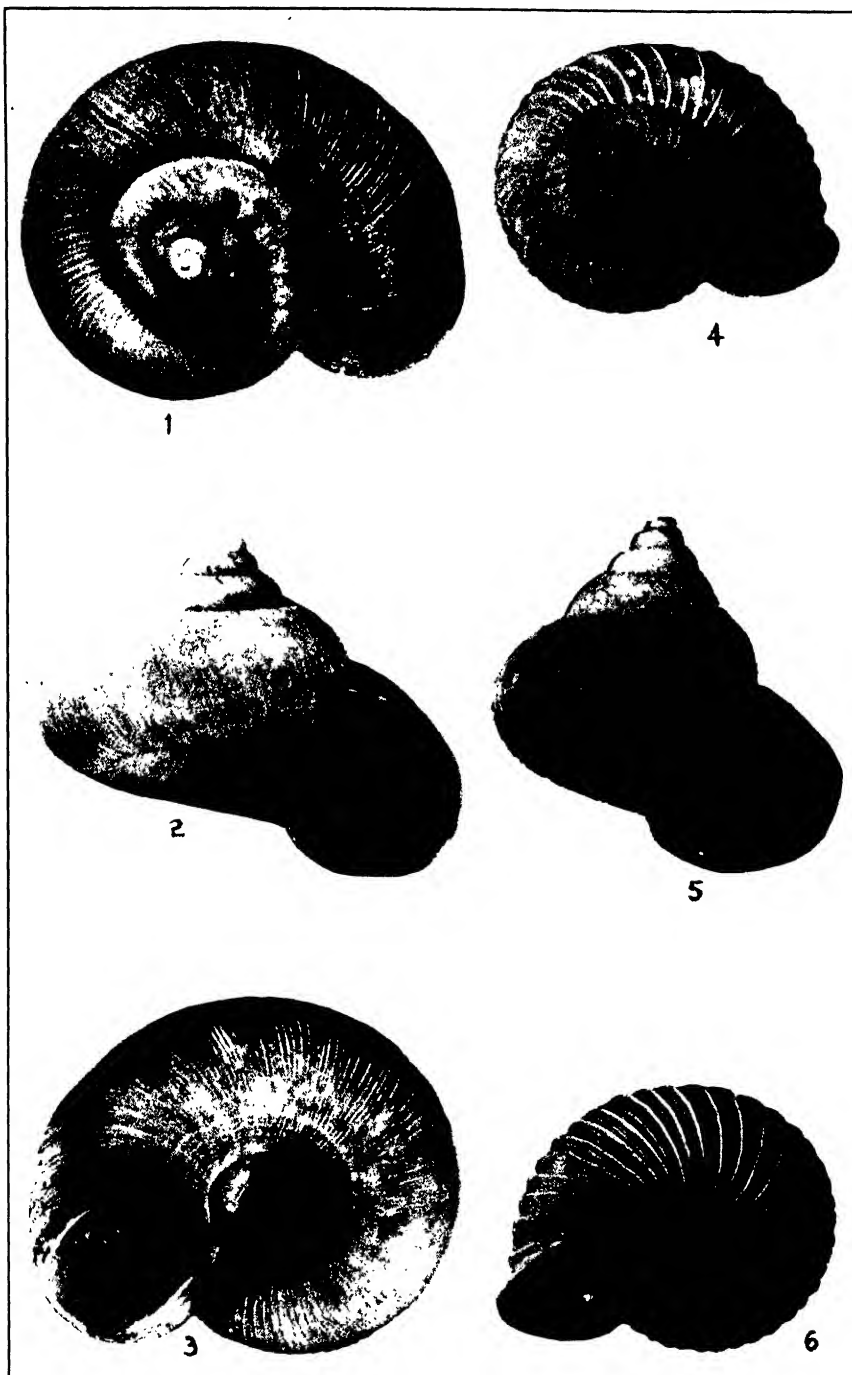


SPECIES OF ANNULARIA (ANNULARELLA) (X 4)
1-3, *hendersoni*; 4 6, *romeri*; 7-9, *cumulata*.



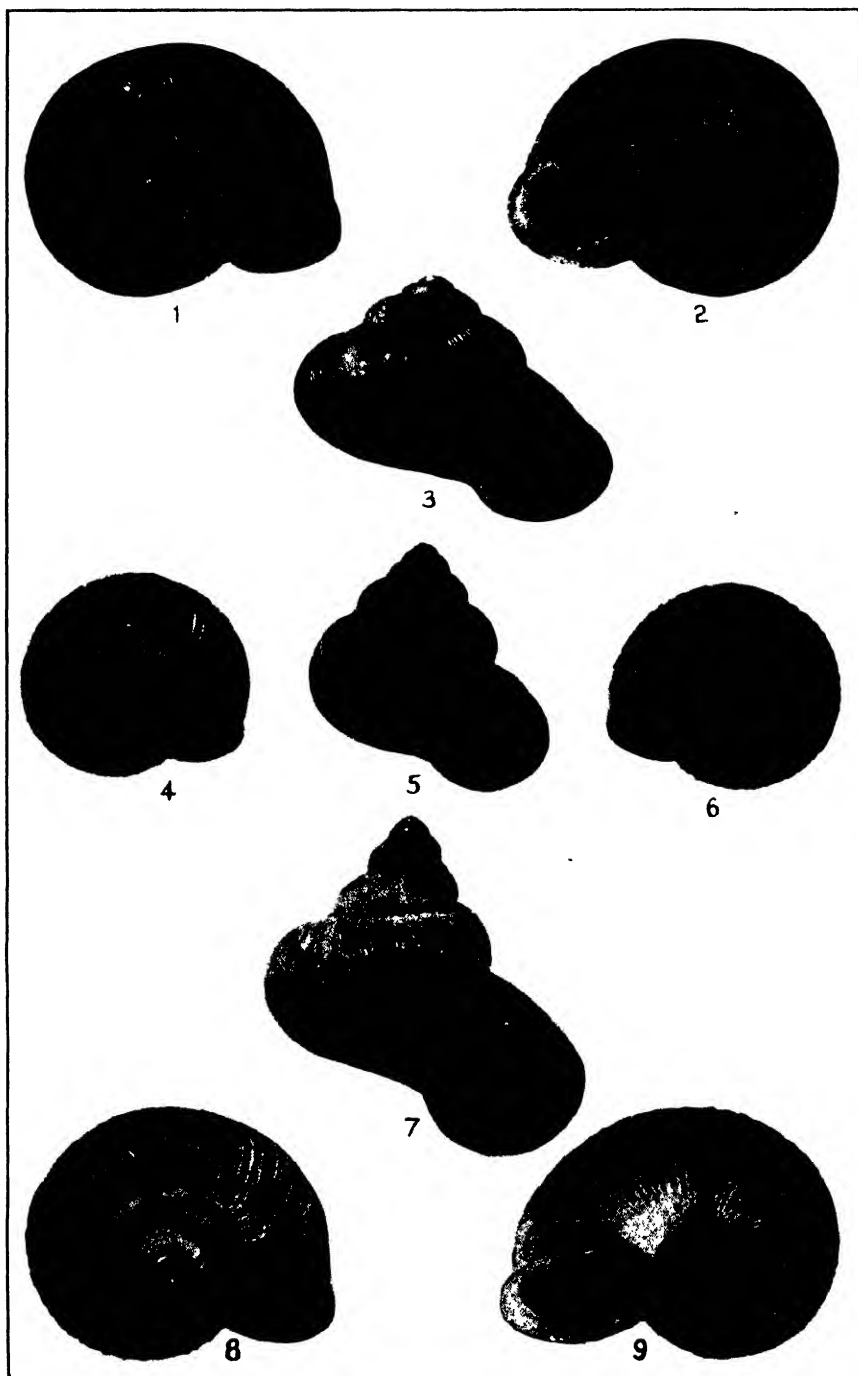
SPECIES OF ANNULARIA (ANNULARELLA) (X 4).

1-3, *heynemanni*; 4-6, *yateravensis*; 7-9, *victoris*.



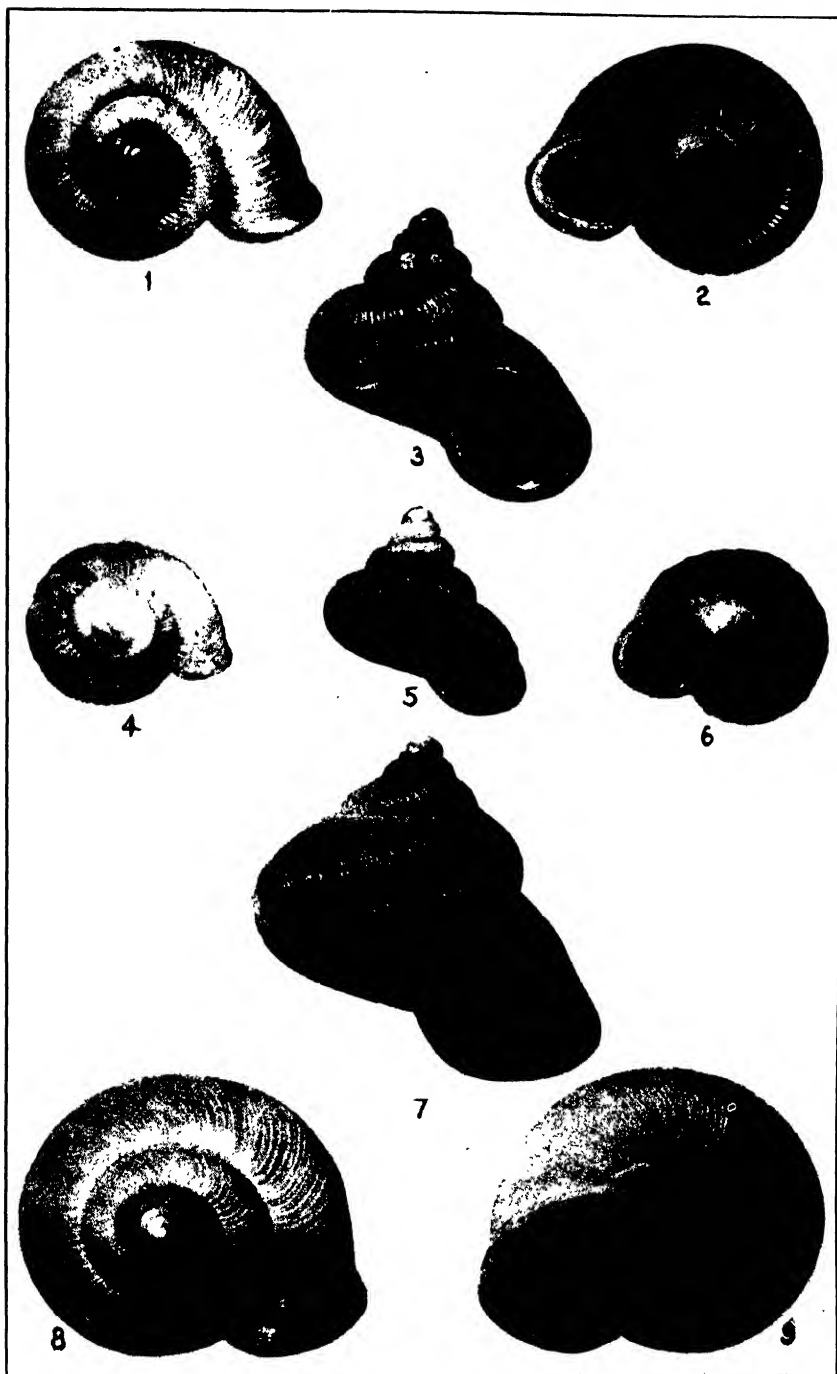
SPECIES OF ANNULARIA (ANNULARELLA) (X 4)

1-3, *pseudalata*; 4-6, *arquesi*.



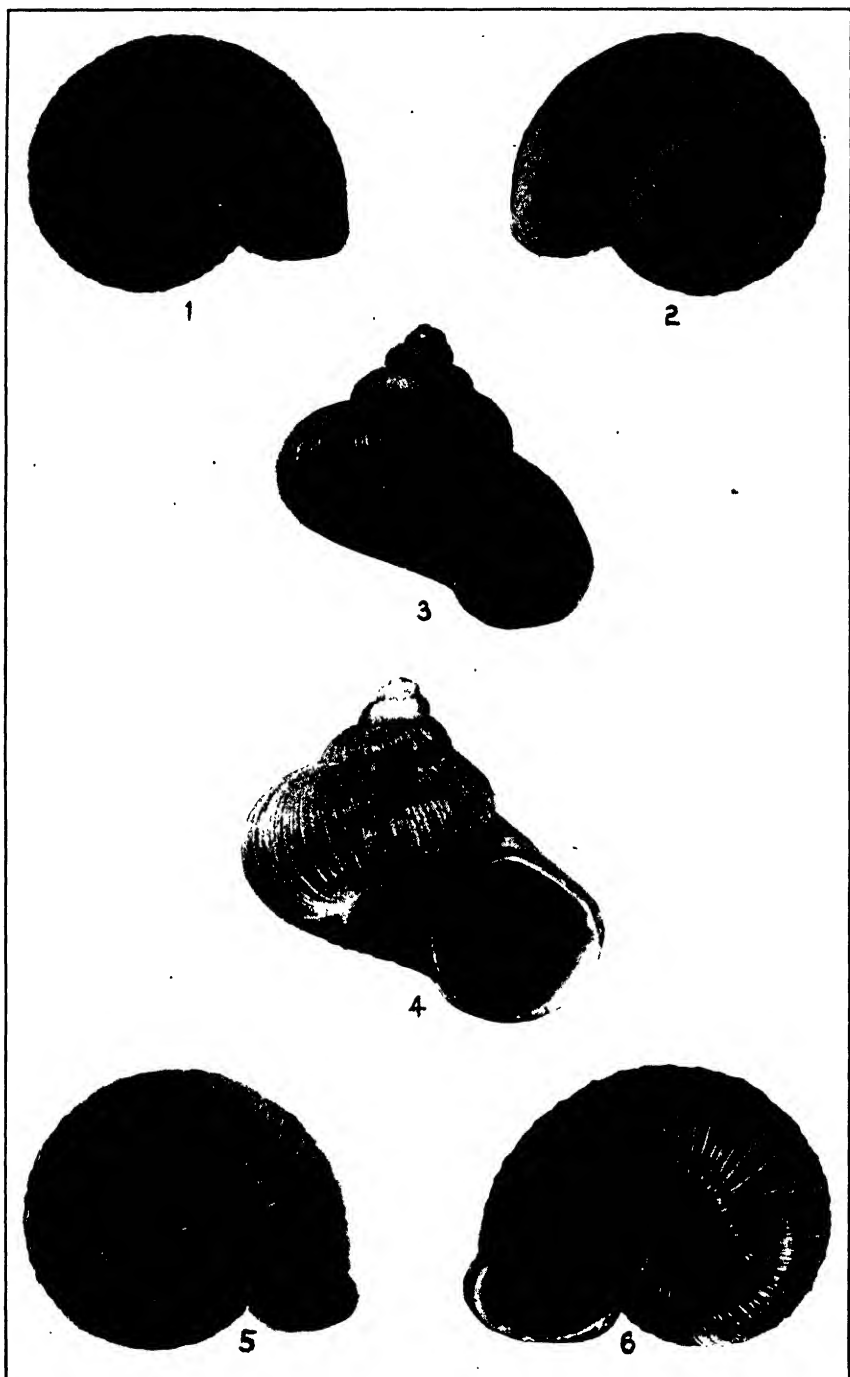
SPECIES OF ANNULARIA (ANNULARELLA) (X 4)

1-3, *holguinensis*; 4-6, *vumuriensis*; 7-9, *nipensis*.

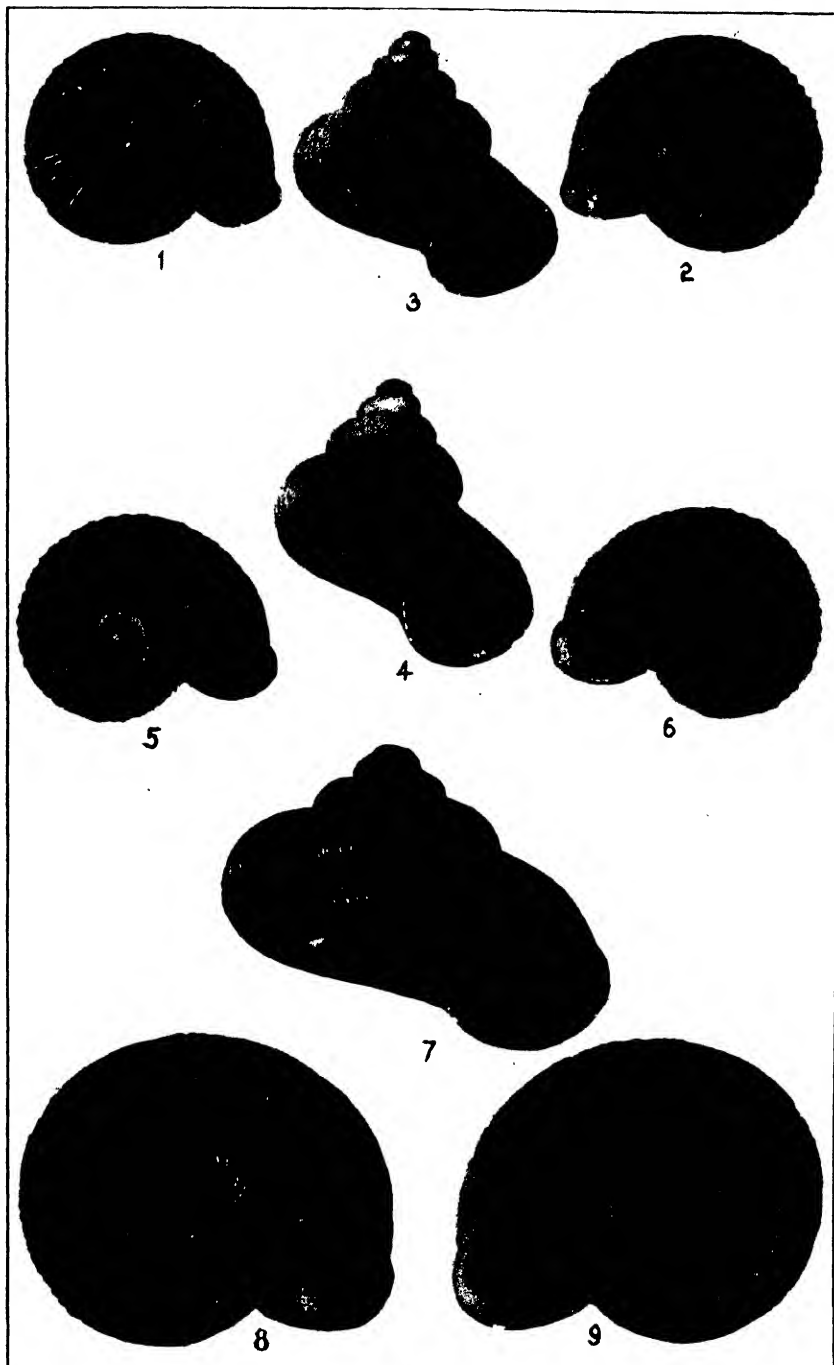


SPECIES OF ANNULARIA (ANNULARELLA) (X 4).

1 3, *tanamensis*; 4-6, *natensoni*; 7 9, *libanoensis*.

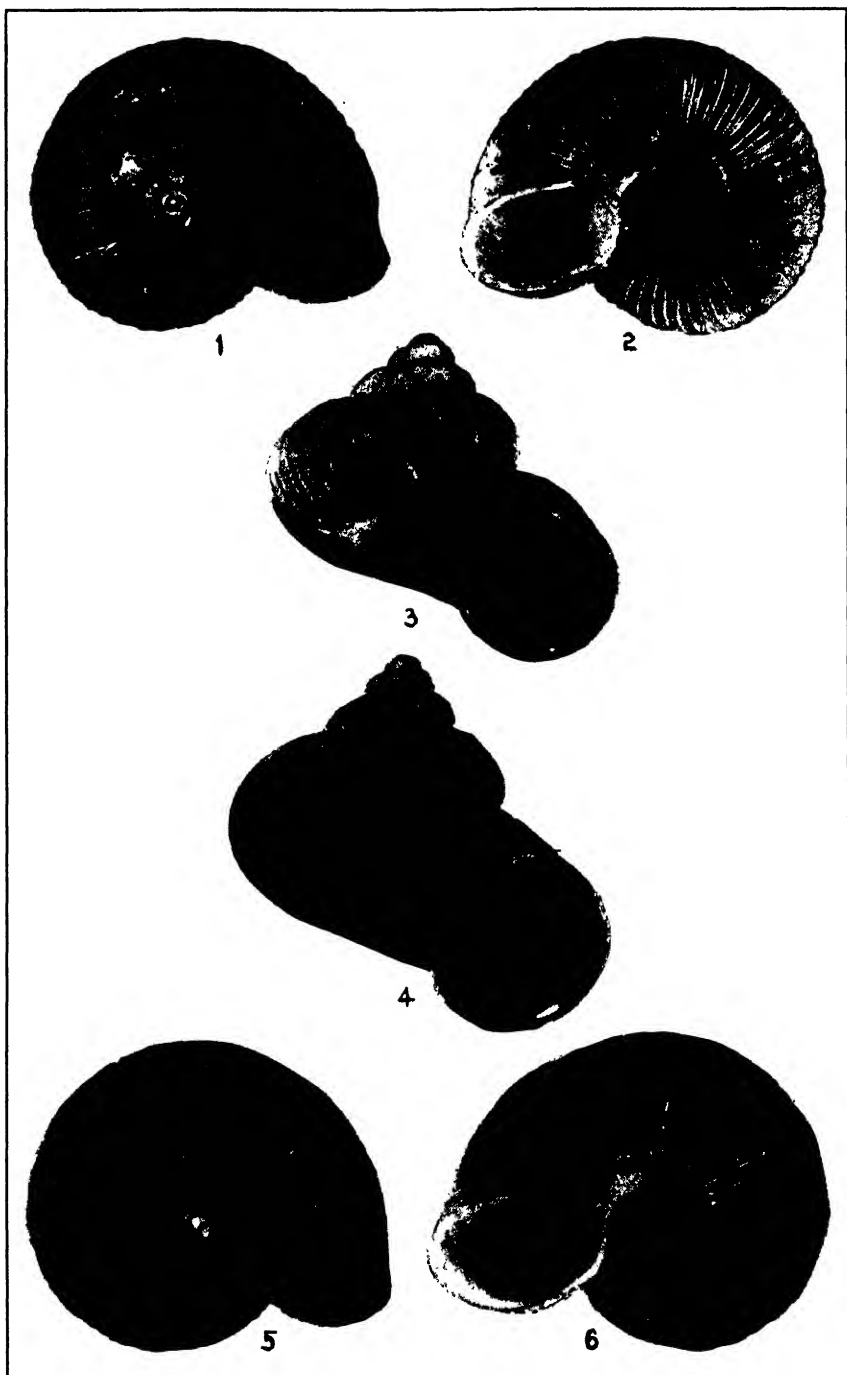


SPECIES OF ANNULARIA (ANNULARELLA) (X 4)
1-3, *toroensis*; 4-6, *interstitialis*.

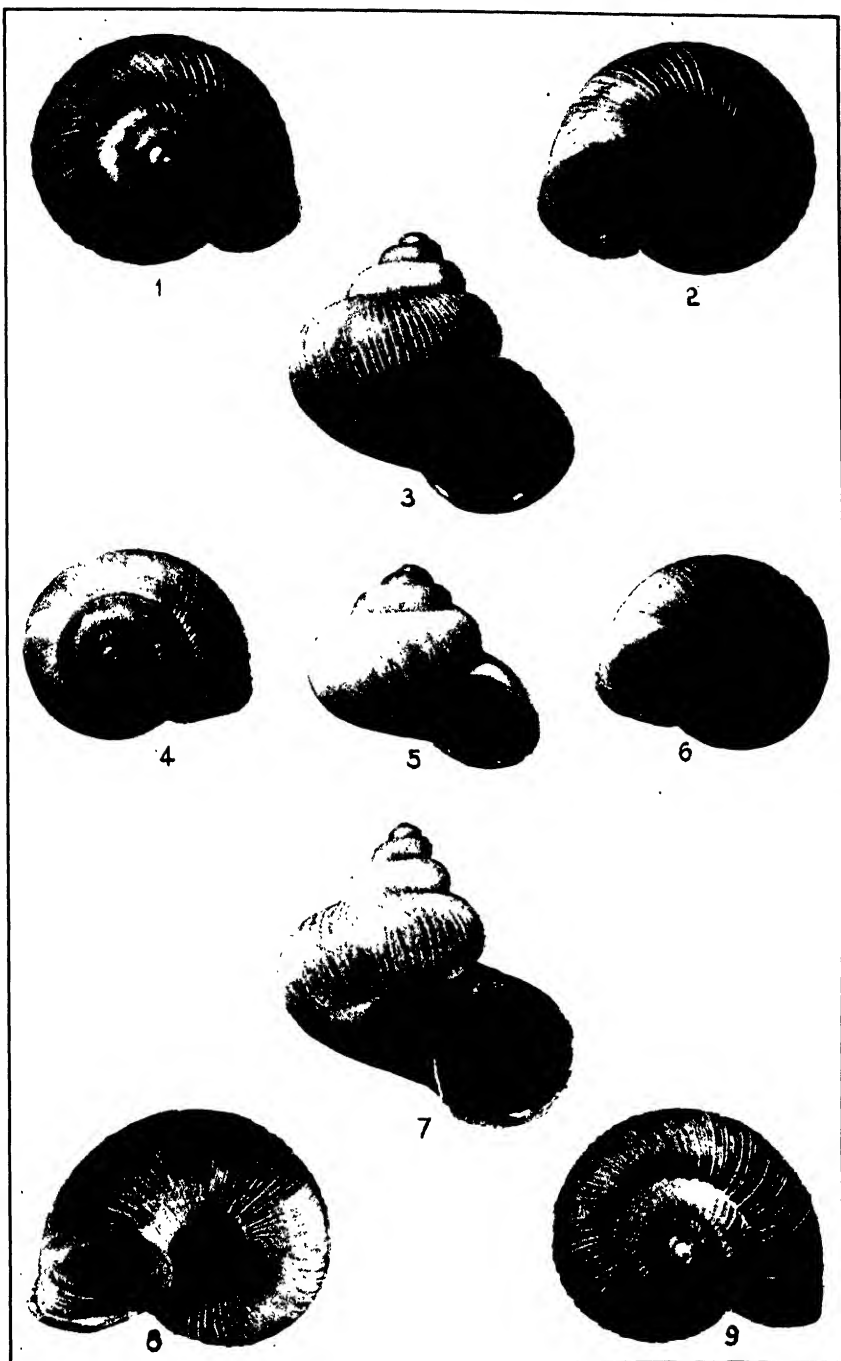


SPECIES OF ANNULARIA (ANNULARELLA) (X 4)

1-3, *yungueni*; 4-6, *wrighti*; 7-9, *mayensis*.



SUBSPECIES OF ANNULARIA (ANNULARELLA) MAYARIENSIS (X 4)
1-3, *mayariensis*; 4, 6, *welchi*.



SPECIES AND SUBSPECIES OF ANNULARIA (X 4).

1-3, *A. (Chondropomatus) mimetica*; 4-6, *A. (C.) lata*; 7-9, *A. (Annularella) mayariensis canapensis*.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3097

SEVEN NEW CRAYFISHES OF THE GENUS *CAMBARUS*
FROM FLORIDA, WITH NOTES ON OTHER SPECIES

By HORTON H. HOBBS, Jr.

While studying many crayfishes that I have collected in Florida in the last few years, and some that have been collected by others, I have noted several forms that appear to be undescribed, and I have rediscovered the true *Cambarus acherontis* of Lönnberg. The new forms are: *Cambarus pallidus*, *C. lucifugus lucifugus*, *C. lucifugus alachua*, *C. hubbells*, *C. kilbyi*, *C. rathbunae*, and *C. pictus*. The first three of these inhabit subterranean waters; the remaining four are surface species.

Some time ago I collected two species of the white crayfishes in the underground waters of Alachua County, Fla. Not having Lönnberg's original description of *C. acherontis* at hand, I followed Faxon (1898, p. 645) and assumed that the specimens from Gum Cave, Citrus County, were *C. acherontis*, and I regarded one of these new species collected in Alachua County as a new race of Lönnberg's species. The manuscript in which I described it was sent to the National Museum for publication, where it was referred to Dr. Leonhard Stejneger. I am very grateful to Dr. Stejneger for pointing out the fact that it was only an assumption on Faxon's part that his material, which was from Gum Cave, Citrus County, was *C. acherontis*. Dr. Waldo L. Schmitt, also of the National Museum, then suggested that I seek to obtain specimens of the true *acherontis* from the type locality.

Lönnberg collected his type material, two blind subterranean crayfishes, in 1893 in an underground rivulet about 42 feet below the surface near Lake Brantley, Orange County, approximately 12 miles

north of Orlando, in the same county, and close to the Seminole County line. These he described and figured as a new species, *Cambarus acherontis* (1894b, p. 6). Unfortunately, both of his specimens, which were males, are no longer extant.

Learning from my friend Ralph Harmon that he had seen white crayfishes in Palm Springs, Seminole County, which lies approximately the same distance north of Orlando as Lönnberg's type locality and actually not more than 2 miles from it, I hastened to the place, together with Mr. Harmon and Lewis Marchand. We found more than two score of white crayfishes lying in the algae over the bottom of a pool formed by the spring. This pool (walled-up for swimming purposes)

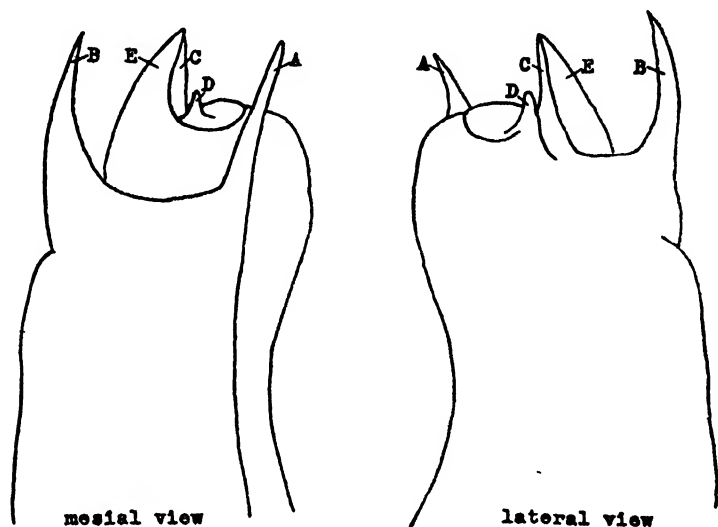


FIGURE 14.—Figure of hypothetical first pleopod of first-form male to illustrate descriptive terminology: *A*, Mesial process; *B*, cephalic process; *C*, centrocaudal process; *D*, caudal process; *E*, centrocephalic process. The so-called central projection of the pleopod is made up of the juxtaposed centrocaudal and centrocephalic processes, *C* and *E*.

measures about 60 by 20 feet; most of it is approximately 6 feet deep. The walls and bottom were covered with a thick algal growth and deposited on it was a sediment characteristic of sulphur springs. The water had a pH of 7.6. Mr. Marchand caught most of the 44 specimens that we secured by diving to the bottom and capturing them with his hands. They were extremely sluggish, many lying in the algae on their backs with their feet turned up toward the surface as though dead. Even after they were bagged there was little sign of life.

Comparing these specimens with the description of *C. acherontis* Lönnberg (1894b, p. 6), I find close agreement with the second-form males, but, judging from Lönnberg's figures 5a and 5b, as well as his

description, I do not believe he had a first-form male before him, but rather that both specimens were of the second form. Faxon's statement (1898, p. 646), "I am therefore inclined to believe that the discrepancies between the Swedish author's account of *C. acherontis* and the specimens before me [from Gum Cave] are due to differences in age and sex, and in part to inaccuracy of description and delineation," is unjust as far as his charge of inaccuracy is concerned. Lönnberg's description is remarkably well done. It is regrettable that Faxon failed to investigate the type locality, that he failed to accept Lönnberg's description at its face value, and that he thus confused two cavernicolous species. Faxon's specimens are identical with *C. lucifugus lucifugus*.

At present two groups of cavernicolous crayfishes are known from Florida, each closely related to surface forms. The first of these groups has only one representative, *C. acherontis* Lönnberg; the other is represented by three forms: *C. pallidus*, *C. lucifugus lucifugus*, *C. lucifugus alachua*.

KEY TO SPECIES OF CAMBARUS REFERRED TO IN THIS PAPER

1. Rostrum with lateral spines or with margins broken..... 2
Rostrum without lateral spines, margins smooth..... 7
2. Albinistic (dorsal surface of abdomen pigmented in some); eyes reduced... 3
Colored; eyes well developed..... 4
3. Hook on ischiopodite of fourth pereopod of male simple, not bituberculate.. 6
Hook on ischiopodite of fourth pereopod of male bituber-
culate..... *acherontis* (p. 390)
4. Rostrum broadest at base..... 5
Rostrum broadest distad of base..... *lucifugus lucifugus* (p. 398)
5. Pigment spot in eye..... *lucifugus alachua* (p. 402)
No pigment spot in eye..... *pallidus* (p. 394)
6. First pleopod of male with knoblike projection on distal caudo-
lateral margin..... *pictus* (p. 419)
First pleopod of male without knoblike projection on distal
caulolateral margin..... *pubescens*
7. Areola moderately broad; chelae subovate..... 8
Areola very narrow; chelae strongly compressed dorso-
ventrally..... *advena*
8. Inner margin of palm of chelae of males barbate..... 9
Inner margin of palm of chelae of males not barbate..... 10
9. Hooks on ischiopodites of third and fourth pereopods of
male..... *barbatus*
Hook on ischiopodites of only the third pereopods of male.. *hubbelli* (p. 406)
Hooks on ischiopodites of third and fourth pereopods of male.. *kilbyi* (p. 410)
Hooks on ischiopodites of only the third pereopods of
male..... *rathbunae* (p. 414)

Measurements were taken as follows: *Height of carapace*, where cervical groove intersects the middorsal line; *width of carapace*, the greatest width, generally about midway between cervical groove and

posterior margin of carapace; *length of carapace*, measured along mid-dorsal line from tip of rostrum to posterior margin of carapace; *width of rostrum at base*, measured opposite the anterior terminals of post-orbital ridges; *length of rostrum*, from the postorbital ridge to tip of rostrum; *length of areola*, measured along middorsal line from cervical groove to posterior margin of carapace; *width of areola*, narrowest place between the sutures; *width of chela*, greatest width of palm.

CAMBARUS ACHERONTIS Lönnberg

FIGURE 15

1894. *Cambarus acherontis* LÖNNBERG, Zool. Anz., vol. 17, No. 444, pp. 125-127.
1894. *Cambarus acherontis* LÖNNBERG, Bihang Svenska Vet.-Akad. Handl., vol. 20, Afd. 4, No. 1, p. 6, figs. 1-6.
1903. *Cambarus acherontis* HARRIS, Kansas Univ. Sci. Bull., vol. 2, No. 3, pp. 58, 67,¹ 150, 152, 162.

Diagnosis.—An almost colorless subterranean species with unpigmented eyes. The male with bituberculate hooks on the ischiopodites of the third and fourth pereopods. First-form male without cephalic process on first pleopod, but with subterminal mesial process. A lyre-shaped plateau on the anteroventral portion of the annulus ventralis.

Male (form I).—Body subovate, flattened dorsoventrally. Abdomen slightly narrower than cephalothorax.

Width of carapace in region of caudodorsal margin of cervical groove greater than depth. Greatest width of carapace about midway between caudodorsal margin of cervical groove and caudal margin of cephalothorax.

Areola narrow, 20 times as long as wide. Cephalic region of carapace about 1.45 times as long as areola. Areola sparsely punctate cephalad and caudad. Sides almost parallel for a short distance in middle. (Apex of rostrum broken in male, measurements made to base of apex.)

Rostrum long, narrow, tapering cephalad. Acumen broken; lateral spines short, weakly acuminate. Small secondary tubercles on each margin of rostrum at midlength. Upper surface deeply excavate. Postorbital ridges terminating anteriorly in short spines.

Surface of carapace tuberculate laterally; dorsally polished and slightly punctate. No lateral spines.

Abdomen smooth, slightly longer and slightly narrower than cephalothorax. Anterior section of telson with one spine in each of the posterolateral corners.

Eyes reduced, not pigmented.

Epistome small, margins slightly elevated, with an anterior median spine; undulating laterally.

¹ In part; i. e. excluding "2. Gum Cave, Citrus county""

Antennules of usual form; a spine present on ventral side of basal segment.

Antennae extending caudad slightly beyond tip of telson.

Antennal scale broad; extends cephalad to tip of rostrum; not as long as peduncle of antennae. Broadest anterior to middle. Spine on outer margin weak.

First pereiopod long and slender; palm subovate, entirely tuberculate. Fingers with weak median dorsal ridge and bent decidedly

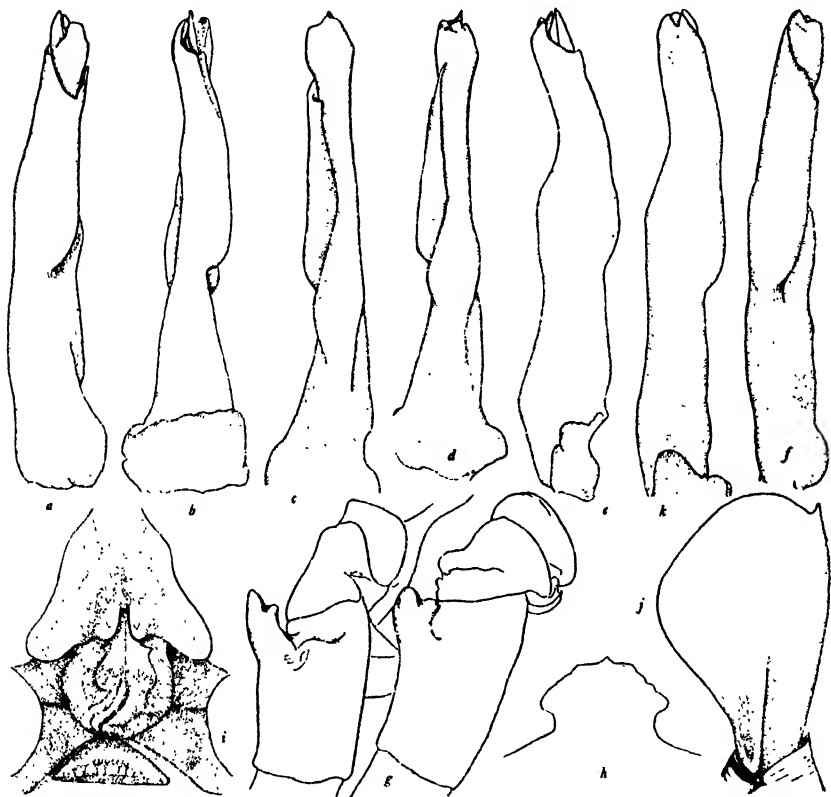


FIGURE 15.—*Cambarus acherontis* Lönnerberg: *a*, Mesial view of first pleopod of male, form I; *b*, cephalic view of first pleopod of male, form I; *c*, caudal view of first pleopod of male, form II; *d*, caudal view of first pleopod of male, form I; *e*, lateral view of first pleopod of male, form I; *f*, mesial view of first pleopod of male, form II; *g*, ischiopodites of third and fourth pereiopods of male, form I; *h*, epistome of male, form I; *i*, annulus ventralis; *j*, antennal scale; *k*, lateral view of first pleopod of male, form II. Pubescence has been removed from all first pleopods.

ventrad. About 11 tubercles in silhouette irregularly arranged along inner margin of palm.

Movable finger with about 19 tubercles along mesial margin; lateral margin with one corneous tubercle in proximal third and about five

very low corneous knobs just distad of this tubercle. Entire lateral margin covered with minute denticles and scattered setae.

Immovable finger with five low, rounded knobs along proximo-mesial margin, just distad of which is a large corneous tubercle. Entire mesial margin with minute denticles. About 11 small tubercles on proximal lateral margin.

Carpus about 1.6 times as long as wide; a shallow oblique groove above. Punctate dorsolaterally, otherwise tuberculate. Two very large tubercles anteroventrad and a row of four smaller ones ventromesad.

Merus entirely tuberculate. Tubercles spikelike ventrad, dorsad, and mesad.

Ischiopodites of third and fourth pereopods with strong, bituberculate hooks.

First pleopod very slender and extending to base of third pereopod; tip terminating in two distinct parts. A third terminal process, the mesial process, somewhat obscured by close proximity with the main shaft, lies along the caudomesial margin and terminates one and one-half times its own length proximad of the tip. It is spiculiform but almost truncate distally. The cephalic process is absent, represented only by a shelf on the anterodistal margin. The central projection is a strongly developed, subtriangular, corneous structure which is flattened laterally and extends beyond the rest of the appendage distally. It is composed of two parts: the centrocaudal and the centrocephalic. A caudal process arises from the caudodistal margin; it is compressed laterally and is directly posterior to the central projection. An excavation is present mesad of the central projection and caudal process.

Male (form II).—Only slightly different from first-form male. Acumen of rostrum very short, not reaching distal end of peduncle of antennule. Epistome with median spine deeply set, otherwise as in the first-form male. Anterior section of telson with two spines in left posterolateral corner and one in the right. Hooks on ischiopodites of third and fourth pereopods simple and reduced. (See fig. 15, *c, f, k*, for diagrams of first pleopod.)

In contrast to Lönnberg's description (1894b, p. 6) there are very small "lateral teeth" on the rostrum of my specimens. The ridge which Lönnberg speaks of as being present in "the foremost part of the rostral groove" is present in one of my specimens. Occasionally an extra spine is added in one or both posterolateral corners of anterior section of telson. Antennae generally slightly longer than body. One of my second-form males agrees perfectly with Lönnberg's description (i. e., proportionally) except that the areola of my specimen is narrower than his; this difference holds in all my specimens. It is possible that this difference is due to our measuring the width of the

areola in different places or to his including the light-colored areas bordering the sutures.

Female.—One or two additional spines are present along left rostral ridge, otherwise like first-form male.

Annulus ventralis movable. Cephalic portion hidden beneath two projections from the sternum just anterior to it. (See fig. 15, i.)

Measurements.—Male, form I: Carapace, height 0.96, width 1.21, length 2.46 cm.; areola, width 0.07, length 1.05 cm.; rostrum, width at base 0.32, length 0.54 cm.; abdomen, length 2.55 cm.; right chela, inner margin of palm 0.80, width of palm 0.47, length of outer margin of hand 2.14, length of movable finger 1.22 cm. Female: Carapace, height 0.92, width 1.27, length 2.52 cm.; areola, width 0.07, length 1.07 cm.; rostrum, width at base 0.31, length 0.56 cm.; abdomen, length 2.50 cm.; right chela, inner margin of palm 0.52, width of palm 0.32, length of outer margin of hand 1.39, length of movable finger 0.73 cm.

Type locality.—Lönnberg's types came from an underground rivulet about 42 feet below the surface near Lake Brantley, Orange County, Fla. My neotypes are from Palm Springs, Seminole County, Fla., not more than 2 miles from Lönnberg's locality.

Disposition of neotypes.—Male (form I), male (form II), and the female, on which the above description is based, are deposited in the United States National Museum, together with four males (form II) and four females. The remaining 33 specimens are in my own collection.

Relationships.—*Cambarus acherontis* probably finds its closest affinities with the group of *Cambarus adrena*.

Remarks.—In 1902 (p. 277), Ortmann included *Cambarus acherontis* along with 15 other species in the first group of *Cambarus*. On the basis of the first pleopod of the first-form male, however, it should be referred to his second group with *C. adrena*. In 1905 (p. 102) he seems to have been influenced in the formulation of his key to species and probably also in his grouping by Faxon's determination of his specimens from Gum Cave as *C. acherontis*, thus further confusing the taxonomic status of this misunderstood species by referring it to the group of *C. blandingi*.

Faxon's record (1914, p. 368) of *C. acherontis* from Eustis, Lake County, is based on two second-form males and seven females, all immature. I have examined these specimens and find that, although they have their closest affinities with *C. lucifugus lucifugus* from Gum Cave, they are certainly not identical with that subspecies, for I have carefully compared the immature specimens from Eustis with immature *lucifugus lucifugus* from Gum Cave. I believe they represent an undescribed subspecies of *lucifugus* because of the morphological

differences they exhibit from the known subspecies and because the various subspecies of *C. lucifugus* are extremely limited in their distribution. The Eustis specimens have the sides of the rostrum more constricted at the base, the body is slightly less granulate, and the epistome is slightly different. In the Gum Cave forms the mesial process of the first pleopod of the male is directed more laterad. As we have no mature specimens, this subspecies will have to remain without a name.

CAMBARUS PALLIDUS, new species

FIGURE 16

1938. *Cambarus acherontis pallidus* HOBBS,² Proc. Florida Acad. Sci., vol. 2, p. 90. *Nomen nudum*.

Diagnosis.—An albinistic subterranean species with unpigmented eyes. Rostrum wider at base than at any point along midlength. The sternum just anterior to the annulus ventralis bears large multi-tuberculate processes, which almost fuse along the midventral line. First pleopod of first-form male bears all five processes and has a hump on anterior surface.

Male holotype (form I).—Body in cross section almost cylindrical, slightly flattened dorsoventrally. Abdomen narrower than cephalothorax.

Width of carapace in region of caudodorsal margin of cervical groove much greater than depth. Greatest width of carapace about midway between caudodorsal margin of cervical groove and caudal margin of cephalothorax.

Areola almost obliterated, about 28 or more times as long as wide, slightly depressed. Cephalic region of carapace about 1.36 times as long as areola. Areola without punctations. Sides parallel for a short distance in middle.

Rostrum long, acutely tapering. Acumen short; lateral spines small. Apex reaching a little beyond base of third segment of peduncle of antennule; upper surface deeply excavate. Postorbital ridges terminating anteriorly in short spines, extending posteriorly about two-thirds the distance between tip of rostrum and cervical groove.

Surface of carapace tuberculate. Tubercles spiniform. Plane only in areola and gastric region, here smooth and polished. Lateral spines trituberculate (only one spine on either side larger than other tubercles). Cephalolateral margins each with one spine near the anterior extremity of cervical groove.

Abdomen slightly narrower and about the same length as cephalothorax. Anterior section of telson with two spines in each of the posterolateral corners.

² Owing to an unfortunate misunderstanding, this manuscript name, based upon my original erroneous interpretation of Lönnberg's *Cambarus acherontis*, appeared shortly before the present paper was ready for publication.

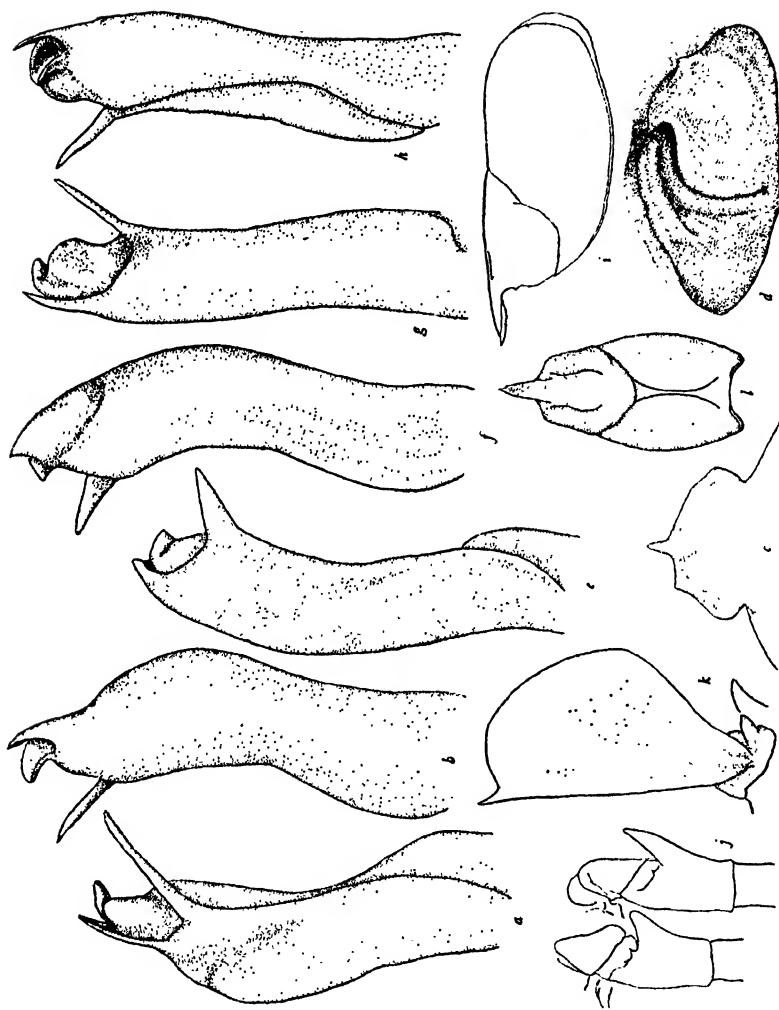


FIGURE 16.—*Cambarus pallidus*, new species: *a*, Mesial view of first pleopod (holotype); *b*, lateral view of first pleopod (holotype); *c*, epistome; *d*, annulus ventralis; *e*, mesial view of first pleopod of male, form II; *f*, lateral view of first pleopod of male, form II; *g*, anteromesial view of first pleopod (holotype); *h*, posterolateral view of first pleopod (holotype); *i*, lateral view of carapace; *j*, ischiopodites of third and fourth pereopods of male, form I; *k*, antennal scale; *l*, dorsal view of carapace. Pubescence has been removed from all first pleopods.

Eyes reduced, not pigmented.

Epistome small, margins slightly raised, with an anterior median spine and a right lateral one—left lateral margin unbroken.

Antennules of usual form; a spine present on ventral side of basal segment.

Antennae extending posteriorly slightly beyond tip of telson.

Antennal scale broad and long, extending almost to third joint of peduncle of antennule; broadest in middle. Spine on outer margin strong, extending beyond tip of rostrum.

First pereopod long, slender, entirely tuberculate; palm ovate, only slightly depressed dorsoventrally. A slight median dorsal ridge along each finger. Outer margin of immovable finger with a distinct ridge.

Movable finger: Inner margin with about 12 corneous and knob-like tubercles along proximal half; the fifth from base the largest. Minute denticles along entire inner margin. Mesial margin with 16 setiferous tubercles. Dorsomedian ridge with a single row of tubercles on each side. Setae extending from base of each distally. Beyond the fifteenth lateromarginal tubercle the tubercles bounding the median ridge have given way to setiferous punctations, which extend on to the tip of the finger on the outer row, but which are not present to the tip on the mesial row. Finger terminates distally in a sharp corneous tip bent laterally and extending below the tip of immovable finger.

Immovable finger: Inner dorsal margin with about 13 corneous tubercles of which the second, third, and fourth are the largest. Between the tenth and eleventh a very large corneous tubercle extends from the ventromesial margin and passes below the movable finger when fingers are brought together. Also, opposite the twelfth tubercle a smaller tubercle extends from the ventromesial margin. Entire mesial margin with minute denticles. Dorsal surface with a median ridge. Lateral margin also with a prominent ridge.

Carpus longer than wide, not so long as inner margin of palm of chela; a shallow, oblique, longitudinal groove above; entirely tuberculate.

Merus entirely tuberculate; ventral side crowded with spikelike tubercles.

Ischiopodites of third and fourth pereopods with hooks. Hooks on the third pereopods rounded and straight; hooks on the fourth with caudoventral surface rounded and cephalodorsal surface excavate.

First pleopod extending to base of the coxopodite of the third pereopod; tip terminating in four distinct parts, as follows: The mesial process is long and spiculiform, directed at about a 45° angle

with the main shaft, and extending beyond the posterior margin of the appendage. The cephalic process is elongate, extending beyond the rest of the appendage distally, and somewhat hooding the central projection anteriorly. The central projection, entirely corneous, is made up of two fused processes: The centrocaudal process, contributed from the lateral base of the cephalic process forms the caudal entity of the central projection; the centrocephalic process arises from the center of the organ and makes up the cephalic entity of the central projection. The whole process is bent caudad at a right angle with the main shaft. The caudal process, also corneous, is a long, curved, bladelike structure forming the posteromesial margin of the tip of the outer part. It is somewhat convex mesially and it is continuous distad with the mesial and anterior controcephalic process of the central projection.

Male (form II).—Only slightly different from the male of the first form. The hooks on the ischiopodites of the third and fourth walking legs are very much reduced. The epistome is more regular, with only a single medial crenation. The other differences are minor variations and need not be pointed out.

Female allotype.—The female is very similar to the male of the first form, differing greatly only in the secondary sexual characters. The sternum just anterior to the annulus ventralis, between the fourth pereopods bearing large multituberculate (three to five tubercles) processes, which almost fuse along the midventral line. (This character alone easily separates the female *C. pallidus* from *C. lucifugus lucifugus*.) Just posterior to the annulus the knoblike structure between the fifth pereopods is small and quadrituberculate. Epistome more regular than in the male, form I, with only a single medial crenation.

Annulus ventralis movable. Sinus arises anteriorly along the midventral line and extends to the left for a short distance, then bends sharply to the right, finally curving gently posteriorly, terminating slightly to the right of the midventral line.

Measurements.—The holotype: Carapace, height 1.4, width 1.71, length 3.47 cm.; areola, width 0.05, length 1.41 cm.; rostrum, width 0.37, length 0.76 cm.; abdomen, length 3.32 cm.; right chela, inner margin of palm 1.14, width of palm 0.69, length of outer margin of hand 3.35, length of movable finger 1.92 cm. The allotype: Carapace, height 1.41, width 1.72, length 3.55 cm.; areola, width 0.08, length 1.42 cm.; rostrum, width 0.37, length 0.83 cm.; abdomen, length 3.34 cm.; right chela, inner margin of palm 1.14, width of palm 0.63, length of outer margin of hand 3.32, length of movable finger 2.05 cm.

Color.—This crayfish is almost snow white in life, turning dark only after preservation. The animals live very successfully in aquaria and

usually retain their white color. I have named this species *Cambarus pallidus* because, in contrast to its closest known relative, *Cambarus lucifugus*, of Gum Cave, Citrus County, Fla., the abdomens of the females are usually snow white, whereas those of *lucifugus* have a straw-brown tint. Males of both species are entirely white.

Type locality.—Warrens Cave, 11 miles northwest of Gainesville, Alachua County, Fla., October 8, 1937.

The male holotype and the female allotype, U.S.N.M. No. 76591, and a second-form male paratype are deposited in the United States National Museum. Of the remaining paratypes, one female has been deposited in the Museum of Comparative Zoology; one female in the University of Michigan Museum of Zoology; one male, form I, three males, form II, and six females are retained in my personal collection.

Distribution.—I collected this new crayfish on March 23, 1935, from a small area of subterranean water exposed in the bottom of a cavelike lime sink in the southern part of Columbia County. Frank N. Young secured a male, form II, and a female from Warrens Cave, 11 miles west of Gainesville, on April 22, 1937. From the same locality, on April 29, 1937, T. Carr collected the first male, form I, I had seen. Since that time, three females and one male, form I, have been added to my collection.

Relationships.—*Cambarus pallidus* has its closest affinities with the cavernicolous forms, *Cambarus lucifugus lucifugus* and *C. lucifugus alachua* (described below). It is probable that *C. pictus* (described below) and *C. pubescens* are its closest surface relatives; the former is probably more closely akin to *C. pallidus* than is the latter.

CAMBARUS LUCIFUGUS LUCIFUGUS, new species and subspecies

FIGURE 17

1898. *Cambarus acherontis* FAXON, Proc. U. S. Nat. Mus., vol. 20, p. 645, pl. 62, figs. 1-5.
1902. *Cambarus acherontis* ORTMANN, Proc. Amer. Philos. Soc., vol. 41, No. 171, p. 277.
1903. *Cambarus acherontis* HARRIS, Kansas Univ. Sci. Bull., vol. 2, No. 3, pp. 67, 150.³
1905. *Cambarus acherontis* ORTMANN, Proc. Amer. Philos. Soc., vol. 44, No. 180, p. 102.

Diagnosis.—A cavernicolous species with unpigmented eyes. Rostrum broadest distad of the base. The sternum anterior to the annulus ventralis is unmodified. First pleopod of first-form male bearing all five processes and similar to that of *C. lucifugus alachua*, but the trough in the caudal process is deeper, and the mesial process is more spiculiform.

³ In part, i. e., reference "2. Gum Cave, Citrus county * * *

Male holotype (form I).—Body subovate, compressed dorsoventrally. Abdomen slightly narrower than cephalothorax.

Width of carapace in region of caudodorsal margin of cervical groove much greater than depth. Greatest width of carapace about

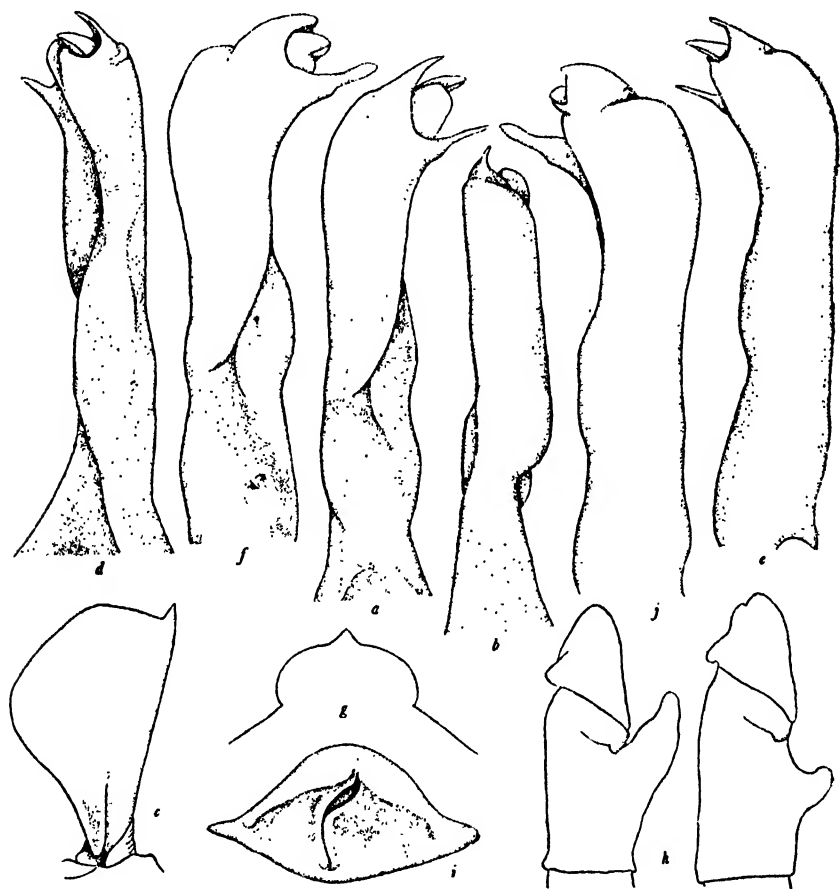


FIGURE 17.—*Cambarus lucifugus lucifugus*, new species and subspecies: *a*, Mesial view of first pleopod of male (holotype); *b*, cephalic view of first pleopod of male (holotype); *c*, antennal scale; *d*, caudal view of first pleopod of male (holotype); *e*, lateral view of first pleopod of male (holotype); *f*, mesial view of first pleopod of male, form II; *g*, epistome of male; *h*, ischiopodites of third and fourth pereopods of male, form I; *i*, annulus ventralis; *j*, lateral view of first pleopod of male, form II. Pubescence has been removed from all first pleopods.

midway between caudodorsal margin of cervical groove and caudal margin of cephalothorax. (Right posterodorsal margin diseased.)

Areola narrow, almost obliterated. Sparsely punctate cephalad and caudad. Sides almost parallel for a short distance in middle.

Rostrum distinctly narrower at base than at midlength, converges slightly anteriorly to form a small lateral tooth on either side, which does not reach distal end of second joint of peduncle of antennule. Upper surface deeply excavate. Acumen extends slightly distad of second joint of peduncle of antennule. Postorbital ridges terminating anteriorly in short spines.

Surface of carapace punctate dorsally and tuberculate laterally; one or two tubercles immediately posterior and laterad of the cervical groove slightly larger than others.

Abdomen smooth, slightly narrower, and shorter than cephalothorax. Anterior section of telson with three spines in each of the posterolateral corners.

Eyes reduced, not pigmented.

Epistome small and minaret shaped, with a small anteromedian spine. Margins slightly raised and unbroken.

Antennules of usual form; a spine present on ventral side of basal segment.

Antennae broken but probably longer than body.

Antennal scale broad; extends cephalad to tip of rostrum; broadest slightly distad of middle. Spine on outer margin strong.

First pereopod long and slender; palm subovate, entirely tuberculate. Fingers bent ventrad without well-defined dorsomedian ridge. About 13 tubercles in silhouette irregularly arranged along inner margin of palm.

Movable finger with about 22 tubercles along mesial margin; lateral margin with about 20 or 21 low tubercles along proximal half. Entire lateral margin with minute denticles.

Immovable finger with about 11 tubercles along proximolateral margin; about 18 tubercles along the proximal dorsomesial margin. Opposite the fifteenth and between the sixteenth and seventeenth are two larger corneous tubercles along the ventromesial margin. Entire mesial margin with minute denticles.

Carpus about 1.8 times as long as wide; a shallow groove above. Entirely tuberculate, although sparsely so dorsad and ventrad. One large spine on the anterior mesioventral margin.

Merus plain proximolaterad, otherwise tuberculate. Tubercles spikelike ventrad and dorsodistad.

Ischiopodites of third and fourth pereopods with strong simple hooks.

First pleopod extends to base of third pereopod; tip terminates in four distinct parts, which are bent at about a 60° angle with the main shaft. The mesial process, which arises from the mesiodistal margin, is spiculiform. The cephalic process is an elongate, acute process with a broad base, which extends across the anterodistal tip of the appendage, hooding the central projection. The central projection

is composed of two corneous, subtriangular plates, the centrocephalic and the centrocaudal, which are flattened laterally. The caudal process, which is also corneous, extends as a sharp ridge (convex mesad) mesad of the central projection and it is directed proximo-distad. The mesial, cephalic, and caudal processes are directed almost parallel.

Male (form II).—Essentially like first-form male; however, the areola is slightly broader than in holotype. Two spines present in each of the posterolateral corners of anterior section of telson. Hooks on ischiopodites of third and fourth pereopods reduced but strongly developed. Antennae longer than body. (See fig. 17, *f, j*, for first pleopod.)

Female allotype.—Differs only slightly from the holotype. Anterior section of telson with four spines in the right posterolateral corner and three in the left. Areola broader than in holotype. Other differences may be noted in measurements.

Faxon (1898, pl. 62, figs. 1, 5) figured the dorsal aspect of a female and the annulus ventralis. (See fig. 17, *i*, for annulus ventralis of allotype.)

Measurements.—The holotype: Carapace, height 1.42, width 1.6, length 3.52 cm.; areola, width 0.05 approximately, length 1.41 cm.; rostrum, width at base 0.41, length 0.79 cm.; abdomen, length 3.35 cm.; right chela, inner margin of palm 1.21, width of palm 0.65, length of outer margin of hand 3.38, length of movable finger 1.90 cm. The allotype: Carapace, height 1.31, width 1.56, length 3.4 cm.; areola, width 0.10 approximately, length 1.31 cm.; rostrum, width at base 0.41, length 0.82 cm.; abdomen, length 3.10 cm.; right chela, inner margin of palm 0.85, width of palm 0.57, length of outer margin of hand 2.84, length of movable finger 1.83 cm.

Type locality.—Gum Cave, about 5 miles southwest of Floral City, Citrus County, Fla. This cave is also known by the names Sweet Gum Cave and Gum Tree Cavern. The material which Faxon had referred to *C. acherontis* in 1898 (p. 645) was also collected in Gum Cave. It is on deposit in the United States National Museum and consists of 2 females and 12 young (males, form II; females). He described and figured the dorsal aspect of a female, the annulus ventralis, and the first pleopod of one of the young males, form II.

The male holotype (No. 77916), the female allotype (No. 77918), and a second-form male paratype (No. 77917) are deposited in the United States National Museum. Of the remaining paratypes one male, form I, and a female have been deposited in the Museum of Comparative Zoology; one male, form I, and a female in the University of Michigan Museum of Zoology; 8 first-form males, 18 females, 2 immature males, and 1 immature female are retained in my own collection.

Distribution.—*Cambarus lucifugus lucifugus* is known from two localities in Florida: One, the type locality, Gum Cave, Citrus County, and the other a cave about 14 miles north of Weekiwatchee Springs, Hernando County.

Relationships.—*Cambarus lucifugus lucifugus* is very closely allied to a cavernicolous form occurring in Alachua County, Fla., *C. lucifugus alachua*.

CAMBARUS LUCIFUGUS ALACHUA new subspecies

FIGURE 18

Diagnosis.—A subterranean albinistic species with a small pigment spot in the eye. Rostrum tapering. First pleopod of first-form male bears all five processes and is similar to that of *C. lucifugus lucifugus*, but the trough in the caudal process is shallower, the mesial process is not so spiculiform, and the central projection is more curved.

Male holotype (form I).—Body subcylindrical, slightly flattened dorsoventrally. Abdomen narrower than cephalothorax.

Width of carapace in region of caudodorsal margin of cervical groove much greater than depth. Greatest width of carapace midway between cervical groove and caudal margin of cephalothorax.

Areola narrow (12 to 13 times as long as wide), not depressed, polished; a single row of punctations in narrowest portion. Anterior section of carapace around 1.6 times as long as areola.

Rostrum narrow, gently tapering, deeply excavate; acumen moderately long, extending from opposite middle of second segment of peduncle of antennule to distal margin of last segment of peduncle of antennule. Lateral spines strong, the left bispinose; many specimens seem to add at random an extra spine on the margin of the rostrum. Postorbital ridges terminating anteriorly in long, sharp spines, posterior margins bearing several spiniform tubercles.

Surface of carapace bearing spiniform and rounded tubercles except dorsally, where it is smooth and polished; gastric region with a few shallow punctations bearing setae at the base. One large lateral spine on either side of carapace. Cephalolateral margins each with one strong spine near anterior extremity of cervical groove.

Abdomen narrower than cephalothorax but equal to it in length. Anterior section of telson with one spine in each of the posterolateral corners.

Eyes reduced; however, bearing a small pigmented spot.

Epistome subtrapezoidal in shape, each of the four corners with moderate spines. Anterior margin concave, with a small triangular process in the middle.

Antennules of the usual form with a strong, slender spine on ventral side of basal segment.

Antennae broken but probably longer than carapace.

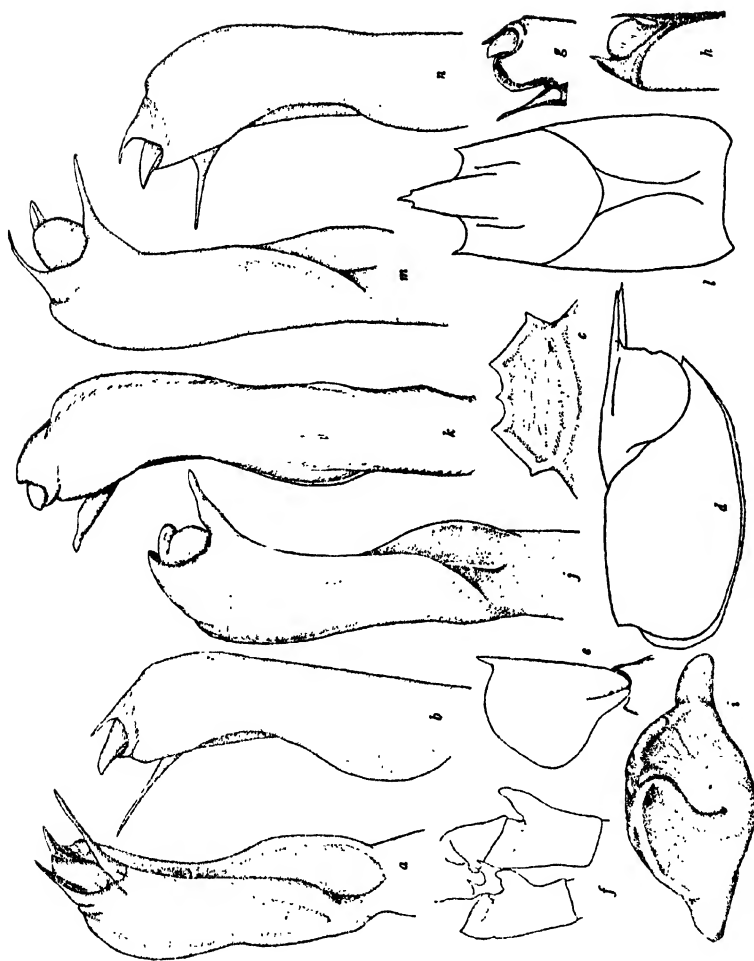


FIGURE 18.—*Cambarus lucifugus alachua*, new subspecies: *a*, Mesial view of first pleopod (holotype); *b*, lateral view of first pleopod (holotype); *c*, epistome; *d*, lateral view of carapace; *e*, antennal scale; *f*, ischiopodites of third and fourth pereopods of male, form I; *g*, posterolateral view of first pleopod (the terminal processes of the holotype); *h*, anteromesial view of first pleopod (the terminal processes of the holotype); *i*, annulus ventralis; *j*, mesial view of first pleopod of male, form II; *k*, lateral view of first pleopod of male, form II; *l*, dorsal view of carapace; *m*, Mesial view of first pleopod of *Cambarus lucifugus lucifugus*, male, form I; *n*, lateral view of first pleopod of *Cambarus lucifugus lucifugus*, male, form I. Pubescence has been removed from all first pleopods.

Antennal scale large, extremely broad; broadest in middle. Spine on outer distal margin strong, extending anteriorly almost to tip of rostrum.

First right pereopod slender, entirely tuberculate; palm oval, depressed dorsoventrally. Median dorsal ridge along each finger; outer margin of immovable finger with distinct ridge.

Movable finger: Inner margin with about 18 corneous and knob-like tubercles along proximal half, the sixth from base the largest; minute denticles along entire inner margin. Mesial margin with about 17 tubercles. Dorsomedian ridge flanked by small irregularly spaced tubercles along proximal half. Distal half flanked by a row of setiferous punctations on either side. Finger terminates distally in a sharp, corneous tip bent laterad and extending below the tip of immovable finger when the fingers are closed.

Immovable finger with inner dorsal margin bearing about 13 corneous tubercles, the third and fifth largest. Between the eleventh and twelfth tubercles a large corneous tubercle extends from the ventromesial margin, and when the fingers are brought together the movable finger passes above it. Distad of this tubercle and in the same line are two smaller tubercles. Entire mesial margin with minute denticles.

Carpus longer than broad, shorter than inner margin of palm of chela; a shallow, oblique longitudinal groove above; tuberculate except on ventral surface.

Merus tuberculate except along the proximomesial and proximolateral surfaces. Ventral side crowded with spikelike tubercles.

Ischiopodites of third and fourth pereopods bearing hooks. Hooks corneous; both recurved toward the base of ischiopodite distally. Hook on fourth pereopod heavier.

First pleopod extending to base of third walking leg; tip ending in four distinct parts, as follows: The mesial process, a long, extremely slender spine, projects posteroventrally and is bent at about a 50° angle with the main shaft. The cephalic process, also spiniform, rises from the anterior margin and projects in a direction almost parallel to the mesial process. The central projection consists of two processes: A centrocaudal process, which is contributed from the cephalic process laterally, forming the caudal entity; a centrocephalic process arising from the center of the appendage and making up the cephalic entity; these two are fused into a triangular platelike process (viewed laterally) bent in the same direction as the mesial process, this triangular process being the largest of the four terminal parts. The caudal process also consists of two parts: A mesial, bladelike, corneous structure directed obliquely anterolaterally and postero-mesially; a small corneous, triangular structure just posterolaterad of, and at the base of, the central projection. The central projection and the caudal process are corneous.

Male (form II).—The second-form male differs from the male, form I, in the following points: The antennae extend beyond the tip of telson, epistome resembles a minaret in silhouette; the rostral spines are normal; however, the acumen bears a spine on the right margin and the right subrostral ridge bears four acute, anteriorly projecting spines, and the left, one; hooks on ischiopodite of both third and fourth pereopods reduced but prominent; all terminal processes of the first pleopod are noncorneous and reduced. Particularly is this true of the cephalic process.

Female allotype.—The shape of the rostrum more nearly approaches that of *Cambarus lucifugus lucifugus* than does the rostrum of the holotype; also the acumen is relatively shorter; the rostral spines are normal. Antennae extending posteriorly to middle of telson. Epistome as in holotype except anteromedian spine is much more prominent. Anterior section of telson with one spine in the left and two in the right posterolateral corner.

Annulus ventralis bearing a prominent ridge along the anterior margin on either side of the median line. Sinus originates on the anterior margin on about the midventral line and extends to the left for a short distance, then turns gently to the right to the midventral line, following it for a short distance to a large tubercle, which arises from the posteromedian surface. Posterior to the annulus and between the fifth pereopods, the sternum is modified into a rounded prominence bearing punctations. The sternum immediately anterior to the annulus is plain.

Measurements.—The holotype: Carapace, height 1.87, width 1.52, length 3.44 cm.; areola, width 0.12, length 1.30 cm.; rostrum, width 0.42, length 0.87 cm.; abdomen, length 3.54 cm.; right chela, inner margin of palm 1.14, width of palm 0.63, length of outer margin of hand 3.41, movable finger 2.15 cm.; carpus of first right pereopod, length 0.76, width 0.50 cm. The allotype: Carapace, height 1.40, width 1.57, length 3.52 cm.; areola, width 0.14, length 1.35 cm.; rostrum, width 0.43, length 0.85 cm.; abdomen, length 3.58 cm.; right chela, inner margin of palm 0.84, width of palm 0.47, length of outer margin of hand 2.56, movable finger 1.57 cm.; carpus of first right pereopod, length 0.79, width 0.40 cm.

Type locality.—A small cave, Hog Sink, about 10 miles west of Gainesville, Alachua County, Fla. The cave is located in high pine-woods owned by the Cummer Lumber Co., and it is very difficult to find, as no road leads to it. The cave extends downward 25 to 35 feet and then to the north about the same distance. The greater portion of it is occupied by a pool of clear, cool water, with a pH of 7.1. The pool is shallow at the south and slopes gently deeper to the north. Light reaches the southern edge of the pool, but the northernmost edge is dark. The specimens were taken on November 30, 1937.

The male (form I) holotype and the female allotype (No. 76592) and a male (form II) paratype are deposited in the United States National Museum; a male (form II) and a female in the University of Michigan Museum of Zoology; one male (form I), one male (form II), 18 females, 9 immature males, and 20 immature females are retained in my personal collection.

Relationships.—*Cambarus lucifugus alachua* is most closely related to *C. lucifugus lucifugus* of Gum Cave, Citrus County, Fla. I have found specimens which appear to be intergrades between these two subspecies in Marion County. The range of this new subspecies, as far as my collections show, is the central western part of Alachua County, while *Cambarus lucifugus lucifugus* has been collected from Citrus and Hernando Counties, Fla. Thus it seems logical that, if there be a transition group, Marion County is the place to expect it, and there is little doubt in my mind that my specimens from Indian Cave, Marion County, are intergrades, *lucifugus* \times *alachua*.

CAMBARUS HUBBELLI, new species

FIGURE 19

Diagnosis.—Areola relatively broad. Rostrum without lateral spines. Male with hooks on the ischiopodites of the third pereopod only, and the chelae with the inner margin of the palm barbate. First pleopod of first-form male bearing all five processes; the caudal process forms a fanlike structure along the caudolateral margin; a terminal tuft of setae is borne on a small distal knob.

Male holotype (form I).—Body moderately slender, somewhat thickened dorsoventrally. Abdomen only slightly narrower than cephalothorax.

Carapace subovate. In region of caudodorsal margin of cervical groove, width of carapace slightly greater than depth. Greatest width of carapace just posterior to the posterodorsal margin of the cervical groove.

Areola about 5.2–5.3 times as long as wide, not depressed. Cephalic region of carapace more than twice as long as areola; three irregular rows of punctations present in areola. Sides parallel for a short distance in middle.

Rostrum suboblanceolate, directed ventrad anteriorly, terminating, however, in a slightly upturned tip, apex just reaching distal end of second joint of peduncle of antennule, upper surface punctate, plane, with margins only slightly elevated. Cephalic region, in lateral aspect, with two rounded prominences: The anterior, consisting of the rostrum, which extends posteriorly to the anterior end of the postorbital ridges; and the posterior, which extends from the anterior edge of the postorbital ridges to the cervical groove, and is more highly arched at

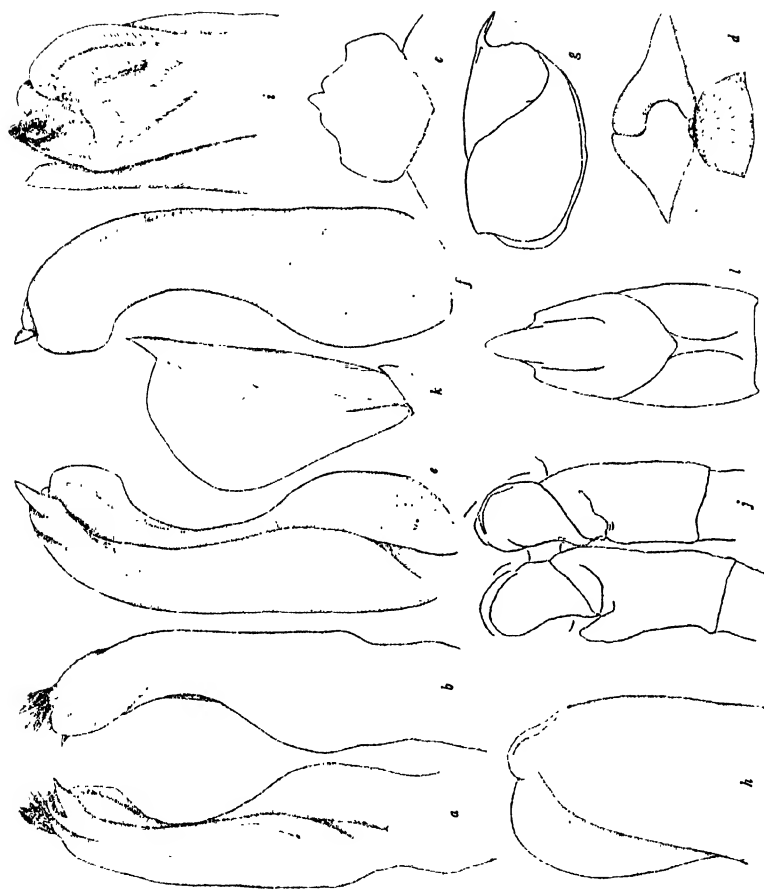


FIGURE 19.—*Cambarus hubbelli*, new species: *a*, Mesial view of first pleopod (holotype); *b*, lateral view of first pleopod; *c*, epistome; *d*, annulus ventralis (allotype); *e*, mesial view of first pleopod of male, form II; *f*, lateral view of first pleopod of male, from II; *g*, lateral view of carapace; *h*, anterior view of terminal processes of first pleopod of male (holotype); *i*, posterior view of terminal processes of male (holotype); *j*, ischiopodites of third and fourth pereopods (holotype); *k*, antennal scale; *l*, dorsal view of carapace. Pubescence has been removed from all first pleopods except the terminal tuft of hairs on figs. *a*, *b*.

midlength than the anterior. Postorbital ridges extending posteriorly more than half the distance between apex and cervical groove.

Surface of carapace punctate, with minute tubercles laterally. No lateral spines present. Cephalolateral margins each with one spine near the anterior extremity of cervical groove.

Abdomen slightly longer and slightly narrower than carapace. Anterior section of telson with two spines in each of the postero-lateral corners.

Ventral surface of cephalothorax and third maxillipeds heavily barbate.

Epistome broader than long, margin elevated with two strong obtuse median crenations and two weaker lateral crenations.

Antennules of the usual form. A spine present on ventral side of basal segment.

Antennae extending posteriorly about midway of the fourth abdominal segment.

Antennal scale of moderate size, broadest anterior to middle, extending to the tip of the second joint of peduncle of antennule, spine on outer margin strong.

First pereiopod heavy. Setiferous punctations scattered over entire hand; inner margin of palm barbate (sometimes only the right). A single distinct dorsomedian ridge along both fingers. Outer margin of immovable finger with a distinct ridge.

Movable finger: Inner margin with about 11 truncate or knoblike tubercles; the distal half crowded with minute denticles. Mesial margin with about 13 small tubercles irregularly arranged along proximal half. Dorsal surface with a median ridge.

Immovable finger: Inner margin with about 11 truncate or knoblike tubercles; the fourth from base and the eleventh largest; the eleventh not in line with the others but slightly more ventrad. Minute denticles crowded along the distal third. Outer margin bears a ridge with a single row of setose punctations on either side. Dorsal surface also with a median ridge.

Carpus longer than wide, not so long as inner margin of palm of chela, a shallow longitudinal groove above, inner side tuberculate, otherwise covered with setiferous punctations.

Merus with scattered tubercles above and sparsely punctate laterally and mesially; ventromesial margin with about 16 serrations; ventro-lateral margins with about 16 irregularly spaced tubercles; antero-oblique margin joining these with four tubercles.

Ischiopodites of the third pereiopods hooked. Hooks simple, moderately strong; caudodorsal surface excavate.

First pleopod extending to anterior margin of coxopodite of fourth pereiopod. Tip terminating in four distinct parts, as follows: The

mesial process, a subcylindrical, subulate, corneous one, extends caudoventrally at about a 50° angle with the main shaft and does not extend beyond the rest of the terminal processes distally. The cephalic process consists of a very low, noncorneous, knoblike structure bearing a terminal tuft of setae; extending from its mesial margin is a larger, corneous, triangular process which somewhat shields the central projection anteriorly. The central projection, entirely corneous, consists of two partially fused processes: A small centrocaudal process (contributed from the lateral base of the knoblike structure) smaller than the centrocephalic process and extending only about halfway to the tip of the latter; the centrocephalic process, somewhat compressed laterally, arises from the center of the appendage, is directed caudoventrally, and is distally deflected at about a right angle with the main shaft. The caudal process is a large, corneous, fanlike structure situated along the distal posterolateral surface.

Male (form II).—The second-form male differs from the first-form male in a few minor details. Chiefly, the spiny parts are all reduced and the first pleopod bears no corneous tips.

Female allotype.—Besides the sexual characters, the female shows the following distinctive structures differing from those described in the male: Chelae proportionally smaller; anterior section of telson with three spines in the left and two in the right posterolateral corner; antennae broken but would scarcely have reached the posterior margin of carapace; 8 to 10 spines irregularly spaced along inner side of hand.

Annulus ventralis movable; sinus extending from middle of anterior margin posteriorly about one-third of the length of the annulus, bends sharply to the left and slightly anteriorly, then curves gently to the right and posteriorly to the posterior margin, cutting it slightly to the left of the midventral line. A distinct fossa is not present. Just posterior to the annulus a truncate spine is present on the sternum between the fifth pereopods.

Measurements.—The holotype: Carapace, height 1.33, width 1.29, length 2.51 cm.; areola, width 0.14, length 0.76 cm.; rostrum, width 0.45, length 0.60 cm.; abdomen, length 2.70 cm.; right chela, inner margin of palm 0.90, width of palm 0.90, length of outer margin of hand 2.29, length of movable finger 1.23 cm. The allotype: Carapace, height 1.28, width 1.18, length 2.54 cm.; areola, width 0.19, length 0.76 cm.; rostrum, width 0.42, length 0.60 cm.; abdomen, length 2.70 cm.; right chela, inner margin of palm 0.55, width of palm 0.52, length of outer margin of hand 1.40, length of movable finger 0.80 cm.

Type locality.—A roadside ditch in the flatwoods 1 mile east of Bonifay, Holmes County, Fla., on State Highway No. 1. About 50 yards east of where I collected the type specimens is a cypress pond and swamp. Grasses, *Drosera capillaris* Poirét, *Rhexia* sp., and

pinces are common. Many pine stumps are left, and their dead roots make it difficult to dig out the crayfish. The soil is a sandy-clay mixture, and the burrows range from 1 to 2 feet deep. Most of the burrows occur in the banks of the ditch and extend about 1 foot below the water table. The burrows are not simple but are less complex than those of *C. rogersi* or many of the members of the subgenus *Cambarus*. Very seldom do they branch more than twice. Usually the burrows may be easily located by the small chimneys built over the mouths. The specimens were collected on October 25, 1937.

The male holotype and the female allotype (No. 76593) and a male (form II) paratype are deposited in the United States National Museum. Of the paratypes, a male (form I), a male (form II), and a female have been deposited in the Museum of Comparative Zoology; a male (form I), a male (form II), and a female in the University of Michigan Museum of Zoology; a male (form I), a male (form II), and a female in the Charleston Museum; and I have retained 6 males (form I), 12 males (form II), 24 females, 41 immature females, and 29 immature males.

Relationships.—*Cambarus hubbelli* is probably more closely related to *Cambarus barbatus* than to any described species of *Cambarus*. Like *Cambarus barbatus*, its areola is relatively broad, its rostrum is without lateral spines, and the inner margin of the chela is usually barbate; even the body build is similar. *Cambarus hubbelli* bears hooks on the ischiopodites of only the third pereopods, whereas *Cambarus barbatus* has hooks on both the third and fourth, and the sexual characters of each are quite distinct.

It is a pleasure to name this crayfish after Prof. T. H. Hubbell, of the University of Florida, who has so kindly aided me in my work on the distribution of these animals, and whose advice and many valuable suggestions have been of great help in my study of Florida crayfishes.

CAMBARUS KILBYI, new species

FIGURE 20

Diagnosis.—Rostrum without spines. Areola relatively broad. Male with hooks on the ischiopodites of the third and fourth walking legs, and the chelae without beard on the inner margin of the palm. First pleopod of first-form male bearing all five processes; the mesial process, the largest, is heavy and spadelike.

Male holotype (form I).—Body somewhat compressed laterally. Abdomen almost as broad as cephalothorax.

Carapace in region of caudodorsal margin of cervical groove with width slightly less than depth. Greatest width of carapace just posterior to middorsal point of cervical groove.

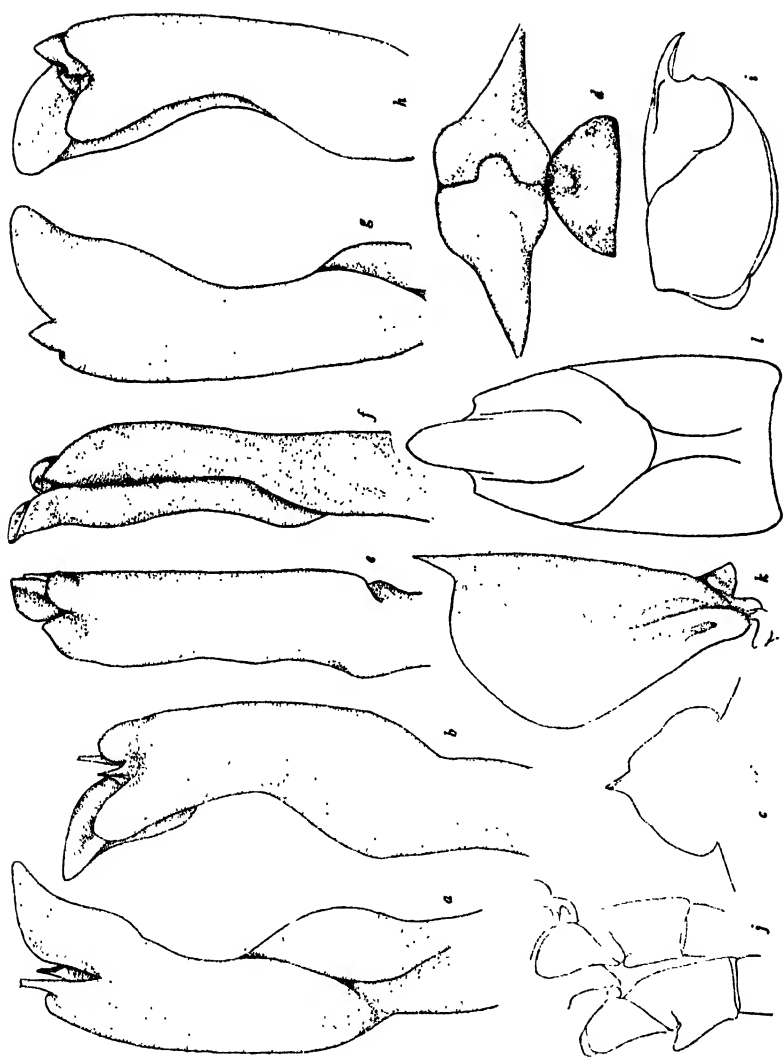


FIGURE 20.—*Cambarus kilbyi* new species: *a*, Mesial view of first pleopod (holotype); *b*, lateral view of first pleopod (holotype); *c*, epistome; *d*, annulus ventralis (allotype); *e*, anterior view of first pleopod (holotype); *f*, posterior view of first pleopod (holotype); *g*, mesial view of first pleopod of male, form II; *h*, lateral view of first pleopod of male, form II; *i*, lateral view of carapace; *j*, ischiopodites of third and fourth pereopods of male, form I; *k*, antennal scale; *l*, dorsal view of carapace. Pubescence has been removed from all first pleopods.

Areola moderately broad and short, about six times as long as broad, not depressed. Cephalic region of carapace about 3.2 times as long as areola. Areola with two irregular rows and a few scattered punctations.

Rostrum without lateral spines, subovate. Margins almost parallel for a short distance at base, only slightly tapering up to apex when they suddenly converge to form a short tip. Apex short and small, reaching base of third segment of peduncle of antennule; upper surface plane, punctate, margins only slightly raised. Postorbital ridges terminating anteriorly without spines and extending posteriorly more than halfway between tip of rostrum and caudodorsal margin of cervical groove.

Surface of carapace punctate, and granulate ventrolaterally, especially anterior to cervical groove. Lateral spines absent. Cephalolateral margins each with a strong spine near anterior extremity of cervical groove.

Abdomen almost as broad as carapace and longer than cephalothorax. Anterior section of telson with two strong spines in each of the posterolateral corners.

Epistome (in ventral view) with margins elevated and each side with two shallow emarginations.

Antennules of the usual form. A spine present on the ventral side of basal segment.

Antennae extending posteriorly about midway of the second abdominal segment.

Antennal scale of moderate size, broadest in middle. Spine on tip of outer margin strong, extending to tip of rostrum.

First pereopod heavy, with setiferous tubercles dorsally and ventromesially. Ventrolateral surface with setiferous punctations. A dorsomedian ridge on each finger, and a distinct ridge on lateral margin of immovable finger. About nine tubercles present along inner margin of palm.

Movable finger: Inner margin with nine corneous, knoblike tubercles. Beginning proximally, tubercles 2, 4, 6, and 8 are largest. Between 5 and 6 and between 7 and 8 a small tubercle is present dorsal to the row just mentioned; between tubercles 8 and 9 are three smaller tubercles. Minute denticles scattered along inner margin distad of the fifth tubercle. Finger entirely setose-punctate. Dorsomedian ridge prominent. Mesial margin with two small tubercles along proximal fifth.

Immovable finger: Mesial margin with 10 knoblike tubercles. The proximal 6 more corneous, and range in size in the following order: The third the largest; second, fourth, and fifth about the same size; first, sixth, seventh, eighth, tenth, ninth, progressively smaller. Besides these a larger tubercle extends from the ventromesial margin

opposite the ninth tubercle, above which the movable finger passes when the fingers are brought together. Minute denticles are scattered along entire mesial margin. Lateral margin with a longitudinal ridge. Entire finger setose-punctate.

Carpus longer than broad, not quite so long as inner margin of palm of chela. A shallow, oblique, longitudinal groove above. Setose-punctate dorsally, laterally, and ventrally. Setose-tuberculate mesially.

Merus with two spines on dorsodistal surface. About 12 to 14 tubercles on ventrolateral margin; about 13 tubercles on ventromesial margin, and about 5 on anteroventral margin. Lateral and mesial surface sparsely punctate. Ventral surface setose-punctate.

Ischiopodites of third and fourth pereopods hooked. Hook on third moderately strong; hook on fourth small and blunt. Caudo-ventral margin of hook on the third rounded, cephalodorsal margin excavate and setose.

First pleopod reaching coxopodite of third pereopod and terminating distally in four distinct parts, as follows: The mesial process, the largest of the four, is a large corneous structure extending ventrally, bent posteriorly at about a 50° angle with the main shaft and extending beyond the rest of the organ distally. The cephalic process consists of a noncorneous, knoblike structure bearing a crest of hairs, and extending ventrally from the mesial margin of the knob is a small, slender, corneous, truncate spine. The central projection, a small corneous triangular process, compressed anteroposteriorly, consists of two fused processes: a centrocaudal process (contributed from the anterior process) forming the lateral part of the projection, and a centrocephalic process rising from the center of the tip and forming the mesial part of the central projection. The caudal process is somewhat rounded and compressed laterally and extends in a ventrocaudal direction bent at about a 45° angle with the main shaft.

Male (form II).—Closely resembles the male of the first form but much less robust; less tuberculate, and all processes and spines greatly reduced. Hooks on ischiopodite of third pereopod reduced almost to vestiges and absent on the fourth. Though all processes of the first pleopod are present, none are corneous or so sharply defined as in the male, form I.

Female allotype.—The female differs only slightly from the male. The chelae are not quite so heavy. Epistome has been injured but normal parts as in the first-form male. Annulus ventralis movable and small. Sinus originates on anterior border near midventral line, extends caudosinistrad, near midlength bends caudodextrad, then turns gently caudad to reach posterior margin at about midventral line. Posterior to the annulus, and between the fifth pereopods, the

sternum is modified into a small domelike structure that terminates ventrally in a truncate spine, the latter flanked by two or three small tubercles.

Measurements.—The holotype: Carapace, height 1.30, width 1.24, length 2.55 cm.; areola, width 0.13, length 0.79 cm.; rostrum, length 0.62, width 0.40 cm.; abdomen, length 2.99 cm.; right chela, inner margin of palm 0.80, width of palm 0.84, length of outer margin of hand 1.99, length of movable finger 1.08 cm. The allotype: Carapace, height 1.18, width 1.15, length 2.31 cm.; areola, width 0.11, length 0.68 cm.; rostrum length 0.54, width 0.39 cm.; abdomen, length 2.77 cm.; right chela, inner margin of palm 0.56, width of palm 0.62, length of outer margin of hand 1.46, length of movable finger 0.83 cm.

Type locality.—A small creek about 7 miles northwest of Blountstown, Calhoun County, Fla., on State Highway No. 6. The water had a slight brownish tint and flowed through dense growth of submerged and emergent vegetation. The specimens were collected on April 17, 1937.

The male holotype (form I) and the female allotype (No. 76594) and a male paratype (form II) are deposited in the United States National Museum. Of the paratypes, a male (form I), a male (form II), and a female are deposited in the Museum of Comparative Zoology; a male (form I), a male (form II), and a female in the University of Michigan Museum of Zoology; 5 males (form I), 10 males (form II), 5 females, 37 immature males, and 43 immature females are retained in my own collection.

Relationships.—*Cambarus kilbyi* has its closest affinities with *C. barbatus* and *C. hubbelli*. The absence of marginal spines on the rostrum, the relatively broad areola, and general body-build, which are common to all three forms, point to a rather close relationship between them. As in *C. barbatus*, hooks are present on the ischiopodites of both the third and fourth pereopods. The color pattern is almost identical with that of *C. hubbelli* (i. e., a gray-greenish background with a light cream mediodorsal stripe and a lateral stripe of the same color on either side running the entire length of the body). The absence of a barbate condition along the inner margin of the palm of the chelae (in the male), however, distinguishes *C. kilbyi*.

I take pleasure in naming this species for John D. Kilby, Resettlement Administration, Montgomery, Ala., in appreciation of assistance and companionship on numerous collecting trips.

CAMBARUS RATHBUNAE, new species

FIGURE 21

Diagnosis.—Rostrum without spines. Areola moderately broad. Male with hooks on the ischiopodites of the third walking legs only, and the chelae without beard along the inner margin of the palm.

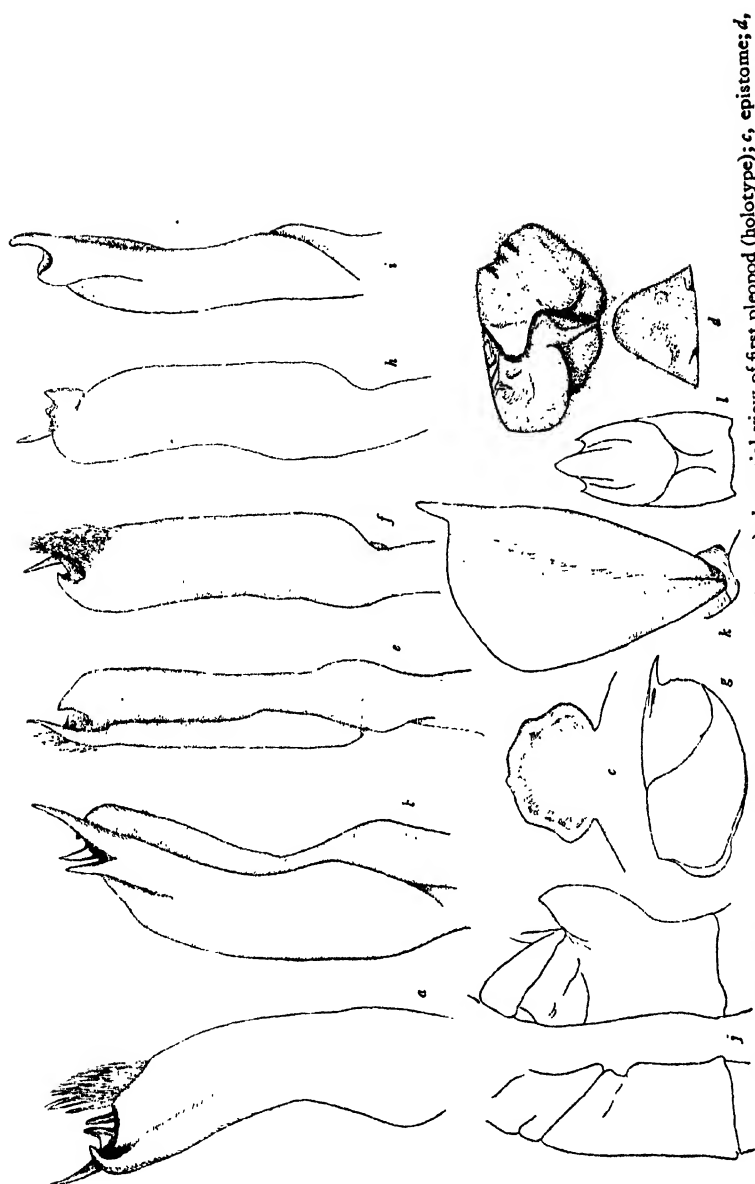


FIGURE 21.—*Cambarus ralbunae*, new species: *a*, Lateral view of first pleopod (holotype); *b*, mesial view of first pleopod (holotype); *c*, epistome; *d*, annulus ventralis (allotype); *e*, posterior view of first pleopod (holotype); *f*, anterior view of first pleopod (holotype); *g*, lateral view of carapace; *h*, lateral view of first pleopod of male, form II; *i*, ischiodipites of third and fourth pereopods of male, form I; *k*, antennal scale; *l*, dorsal view of carapace. Pubescence has been removed from all first pleopods except the terminal tuft of hairs on figs. *a*, *e*, *f*.

First pleopod of first form male bearing all five processes; mesial process slender and extending distad of the other processes; caudal process is recurved distad and terminates in a point.

Male holotype (form I).—Body somewhat compressed laterally; abdomen only slightly narrower than cephalothorax.

Width of carapace in region of caudodorsal margin of cervical groove almost equal to depth; greatest width immediately posterior to caudodorsal margin of cervical groove.

Areola moderately broad and short, with three irregular rows of punctations, about 4.2 times as long as broad, not depressed. Cephalic region of carapace about 2.1 times as long as areola.

Rostrum without lateral spines; margins slightly raised, its apex reaching the base of the third segment of peduncle of antennule; upper surface concave, punctate. Postorbital ridges terminate anteriorly without spines and extend posteriorly more than halfway between tip of rostrum and caudodorsal margin of cervical groove.

Surface of carapace punctate above, granulate laterally. No lateral spines present. Cephalolateral margins each with one spine near anterior extremity of cervical groove.

Abdomen almost as broad as carapace, longer than cephalothorax. Anterior section of telson with two strong spines in left and one in right posterolateral corners.

Epistome with margins slightly elevated; shallowly scalloped (terminating medioanteriorly in a small blunt spine in some specimens, not, however, in the holotype).

Antennules of usual form; a spine on ventral side of basal segment.

Antennae extending posteriorly to base of fourth abdominal segment.

Antennal scale of moderate size, broadest just anterior to middle. Spine on outer margin strong, extending to tip of rostrum.

Right first pereopod heavy. Palm setose-tuberculate; tubercles along mesiodorsal region large and bent distally. Distinct dorso-median ridge on both finger. Lateral ridge on each finger less well developed. Twelve to 13 tubercles along inner margin of palm.

Movable finger: Inner margin with 9 or 10 rounded tubercles, the 4 proximal ones largest and of these the fourth, is the largest; minute denticles along the distal third. Ventromesial and ventrolateral margins setose-punctate. Mesial margin with 10 or 11 tubercles. Dorsomesial, proximal one-third and dorsolateral, proximal one-third with tubercles; distal two-thirds setose-punctate.

Immovable finger with five or six rounded tubercles on mesial margin, the third the largest. Ventromesial surface with one large strikingly corneous tubercle at base of distal third. Distal third with minute denticles. Finger setose-punctate otherwise.

Carpus longer than broad; about equal in length to inner margin of palm of chela, and a shallow longitudinal groove above. Setose-

punctate dorsolaterally, laterally, and ventrally. Tuberculate dorso-mesially and mesially.

Merus with an irregular row of tubercles (about 30) along dorsal margin. Ventrolateral margin with about 18 tubercles. Ventromesial row branching from the ventrolateral row with about 6 tubercles. Ventromesial margin with about 21 tubercles; otherwise mostly plane, sparsely setose-punctate.

Ischiopodites of third pereopods hooked. Caudovernal surface of hook rounded, cephalodorsal surface excavate. Fourth pereopod with a shallow groove on the ischiopodite, its raised margin suggesting a rudimentary hook; the rounded tubercle distad of the groove very poorly developed.

First pleopod reaches the coxopodite of third pereopods, the tip ending in four distinct parts, as follows: The mesial process, a long corneous spine, extending beyond the rest of the appendage distally and bending slightly laterally; the cephalic process arising from the anteromesial part of the organ and forming a slender corneous spine; the central projection, an anteroposteriorly flattened, triangular process, extending distad beyond the cephalic process, and consisting of two processes, a mesial or centrocephalic process arising from the center of the appendage, and a lateral or centrocephalic process contributed from the lateral surface of the cephalic process; and the caudal process arising from the posterolateral surface and distally bending anteriorly almost at a right angle with the main shaft.

Male (form II).—Differs from the male of the first form in only a few minor points, chiefly in the smaller degree of accentuation of the tuberculate and spiny portions. The complex arrangement of the first pleopod is much simplified and the caudal process is not even present as a vestige. The anterior section of the telson bears two spines in each posterolateral corner. A small median spine is present on the middle anterior margin of epistome.

Female allotype.—A reduced heaviness of the chelae is one of the most striking dissimilarities between the two sexes. Annulus ventralis small, movable, with large irregular tubercles on anterolateral surfaces. The sinus, beginning slightly to the left of the midanterior margin, curves gently to the right of the midventral line, then somewhat more sharply to the left, again crossing the midventral line, where it then curves gently once more to the midposterior margin. Just posterior to the annulus the sternum is modified into a small, trapezoidal, rounded plate, whose surface is broken by about six tubercles; the two occupying the posterolateral corners are larger, more nearly spiniform, and are directed mesially. Surface of sternum, immediately anterior to annulus unbroken, though the median trough is somewhat narrow with overhanging walls.

Measurements.—The holotype: Carapace, height 1.26, width 1.27, length 2.65 cm.; areola, width 0.20, length 0.84 cm.; rostrum, width 0.35, length 0.51 cm.; abdomen, length 3.00 cm.; right chela, inner margin of palm 0.82, width of palm 0.85, outer margin of hand broken, length of movable finger 1.14 cm.; carpus of first pereopod (right), length 0.82, width 0.61 cm. The allotype: Carapace, height 1.47, width 1.39, length 2.92 cm.; areola, width 0.20, length 0.97 cm.; rostrum, width 0.35, length 0.51 cm.; abdomen, length 3.29 cm.; right chela, inner margin of palm 0.66, width of palm 0.73, length of outer margin of hand 1.78, length of movable finger 1.07 cm.; carpus of first pereopod (right), length 0.76, width 0.50 cm.

Type locality.—Near the Yellow River at Milligan, Okaloosa County, Fla., at intersection of State Highway No. 41 and U. S. Highway No. 90. The crayfish were dug from simple burrows in the roadside ditches. The burrows ranged in depth from 1 to 2 feet, reaching the water-table 6 inches to a foot below the surface of the ground. Several of the burrows were open, though the majority of them were marked by low, closed chimneys. The soil is a sandy-clay mixture, and the ground is covered with a thick mat of grass. Some sections of the ditch held water, but at this time most of it was dry. The specimens were collected on April 4, 1938.

The male holotype (form I) and the female allotype (No. 76595) and a male paratype (form II) are deposited in the United States National Museum. Of the paratypes, a male (form II) and a female have been deposited in the Museum of Comparative Zoology; a male (form II) and a female in the University of Michigan Museum of Zoology; a male (form I), two males (form II), and six females have been retained in my own collection.

Relationships.—A rostrum without lateral spines, a broad areola, and a rather short, thick body are characteristic of four Florida crayfishes: *Cambarus barbatus*, *C. hubbelli*, *C. kilbyi*, and *C. rathbunae*. Peculiar to *C. rathbunae* and *C. hubbelli* is the presence of hooks on the ischiopodites of only the third pereopod; however, in *C. rathbunae* the ischiopodites of the fourth pereopods bear a tubercle which suggests a rudimentary hook. Peculiar to *C. rathbunae* and *C. kilbyi* is the lack of the barbate condition on the palm of the chelae in the male. It is to be noted that the first pleopod of *C. rathbunae* is much more like that of *C. barbatus* than that of *C. hubbelli* or *C. kilbyi*.

It is a pleasure to name this species for Dr. Mary J. Rathbun, Associate in Zoology in the United States National Museum.

CAMBARUS PICTUS, new species

FIGURE 22

Diagnosis.—Margins of rostrum with angular interruptions. Areola broad. Male with hooks on the ischiopodites of the third and fourth walking legs. First pleopod of first-form male bearing all five processes; caudal process consisting of three distinct parts—a caudolateral knob, a more mesial curved platelike structure partially enclosing the third part, which is a small toothlike structure.

Male holotype (form I).—Carapace subovate, compressed laterally. Abdomen only slightly narrower than cephalothorax. In region of caudodorsal margin of cervical groove, width slightly greater than depth. Greatest width of carapace just posterior to caudodorsal margin of cervical groove.

Areola broad, length but slightly more than twice width, not depressed. Cephalic portion of carapace more than two and one-half times as long as areola. Punctations somewhat irregularly arranged, about nine in narrowest portion.

Rostrum long, broad, sides parallel at base, converging gently to the lateral spines, which are opposite proximal part of second segment of peduncle of antennule and which mark the base of the long, narrow acumen. The distal end of the acumen opposite midlength of peduncle of antennule. Postorbital ridges terminating anteriorly in acute spines.

Surface of carapace setose-punctate dorsally, and setose and finely granulate laterally with a single strong lateral spine on each side. Cephalolateral margins each with one well-developed spine immediately ventrad of anterior extremity of cervical groove, and a weak tubercle on margin, slightly dorsad of base of antennae.

Abdomen longer than cephalothorax and only slightly narrower. Anterior section of telson with three and four spines in the right and left posterolateral corners respectively.

Epistome subtriangular in shape, heavily barbate, with margins only slightly raised.

Antennules of usual form; a strong spine present on ventral surface of basal segment.

Antennae extending to base of third segment of abdomen.

Antennal scale long, extending anteriorly beyond peduncle of antennule and tip of rostrum, broadest proximal to middle. Lateral margins concave, terminating distally in strong, acute spines.

First right pereopod slender and long, about four times as long as broad. Fingers not gaping. Inner margin of palm almost 1.4 times as long as broad, with a row of about 10 small, regularly spaced tubercles. Entire palm setose-tuberculate, tubercles more crowded on dorsal surface. No distinct ridges on either finger. Mesial margin of

movable finger with a row of about 8 small tubercles along proximal three-fifths. Lateral margin with only one small tubercle near base, but crowded with minute denticles along entire length. Dorsoproximal and ventroproximal surfaces with a few small tubercles, otherwise setose-punctate.

Carpus longer than wide: Ratio about 9:5, shorter than inner margin of chela, a very shallow longitudinal groove above, and entirely tuberculate. Tubercles on mesial and mesiodorsal surface larger and more acute. Two sharp spines on anteroventral margin.

Merus with a row of about 20 tubercles along dorsal margin, progressively larger and more acute from proximal to distal margins. Distad of middle they are flanked by smaller ones. Lateral and mesial surfaces sparsely punctate; about 14 spines along ventromesial margin, and 10 to 15 in an irregular row along ventrolateral margin. A row of 3 tubercles (the more distad the largest) along the distal midventral margin.

Ischiopodites of the third and fourth pereopods hooked. Hooks on the third simple, straight, extending back over the distal part of basipodite. Hook on the fourth pereopod approaches a trituberculate condition. Basipodite of the fourth pereopod bears a large tubercle on the distomesial margin opposing the hook.

First pleopod extending to middle of coxopodite of third pereopod, a rounded hump on midposterior surface, and another at distal one-third of anteromesial surface. Tip terminating in four distinct parts, as follows: The mesial process, which is long, slender, and spiniform, extends caudoventrally. The cephalic process, also spiniform, extends in the same direction and extends distad of the other processes. The central projection consists of two parts: The centrocaudal part contributed from the cephalic process, and the centrocephalic process arising from the center of the appendage, the two fused into a small, acute, platelike structure and bent slightly more mesad and caudad than the mesial and cephalic processes. The caudal process is made up of three parts: A larger, lateral, knoblike structure; a mesial plate-like structure, convex mesially; a small, acute, platelike spine, which rises from between the last two mentioned structures and extends approximately parallel to the mesial and cephalic processes and to the central projection, which exceed it distally. The central projection and caudal processes are corneous.

Male (form II).—With reductions in most of the spiny and corneous portions disregarded, the description of the male, form I, is adequate for the second-form male with the following exceptions: Anterior section of telson with four spines in each of the posterolateral corners; epistome with base angular, both sides slightly concave, spine on anterior edge not acute; first pleopod with no corneous tips and a much-reduced caudal process, a small tubercle indicating the presence

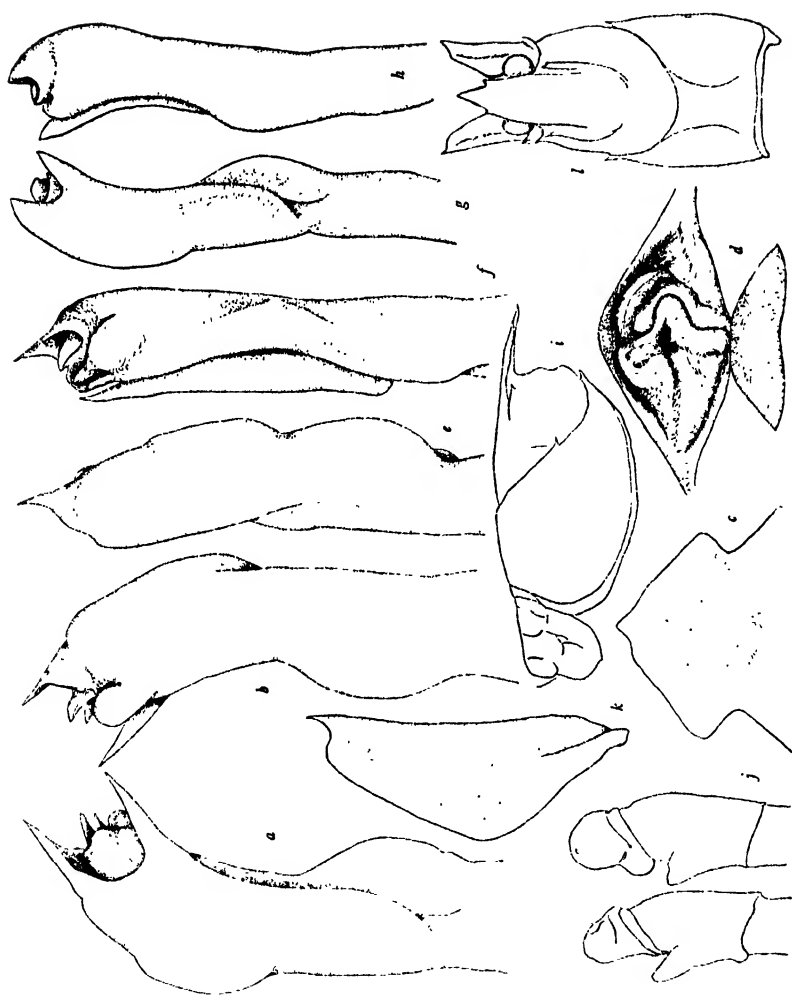


FIGURE 22.—*Cambarus pictus*, new species: *a*, Mesial view of first pleopod (holotype); *b*, lateral view of first pleopod (holotype); *c*, anterior view of first pleopod (holotype); *d*, posterior view of first pleopod (holotype); *e*, lateral view of first pleopod (holotype); *f*, lateral view of first pleopod (holotype); *g*, mesial view of first pleopod of male, form II; *h*, lateral view of first pleopod of male, form II; *i*, lateral view of carapace; *j*, ischiodopods of third and fourth pereiopods of male, form I; *k*, antennal scale; *l*, dorsal view of carapace. Pubescence has been removed from all first pleopods.

of the small acute platelike spine, the other two parts of this caudal process being represented by a rounded ridge across the postero-distal surface of the appendage.

Female allotype.—Essentially like the male, form I, but rostrum extending beyond peduncle of antennule and right antennal scale; also extending anteriorly about the same distance as left antennal scale. Anterior section of telson with three spines in each postero-lateral corner. Epistome as in the male, form II. Merus of first pereiopods with two very large acute spines on ventrolateral margins surrounded by several smaller ones. Also one large acute spine on the anterior mesioventral surface.

Annulus ventralis subelliptical. Two prominent ridges directed obliquely, posterolaterally on anteroventral surface. Sinus arises slightly back of anterior edge along the midventral line, curves immediately to the left, then gently back to the midventral line, where it extends posteriorly, bisecting a rather large tubercle which extends caudad from the main body of the annulus. The sternum immediately posterior to the annulus is modified into a semielliptical structure with a raised anterior margin bearing many small tubercles.

Between the third and fourth pereiopods along the midventral line is a small subovate structure (resembling vaguely the annulus) bearing several ridges and depressions. In the same relative position between the second and third pereiopods is a large, bituberculate structure projecting ventrally.

Measurements.—The holotype: Carapace, height 1.69, width 1.65, length 3.73 cm.; areola, width 0.42, length 1.12 cm.; rostrum, width 0.58, length 1.25 cm.; abdomen, length 4.25 cm.; right chela, inner margin of palm 1.30, width of palm 0.71, length of outer margin of hand 2.71, length of movable finger 1.41 cm.; carpus of right first pereiopod, length 0.96, width 0.54 cm. The allotype: Carapace, height 1.29, width 1.29, length 2.92 cm.; areola, width 0.32, length 0.75 cm.; rostrum, width 0.50, length 1.06 cm.; abdomen, length 3.33 cm.; right chela, inner margin of palm 0.60, width of palm 0.45, length of outer margin of hand 1.44, length of movable finger 0.81 cm.; carpus of right first pereiopod, length 0.60, width 0.37 cm.

Type locality.—A small, swift swamp stream about 2 miles southwest of Green Cove Springs, Clay County, Fla., on Highway No. 48.

The specimens were collected on April 23, 1938.

The male holotype (form I) and the female allotype (No. 76596) and a male paratype (form II) are deposited in the United States National Museum. Of the paratypes, a male (form I), a male (form II), and a female have been deposited in the Museum of Comparative Zoology; a male (form I) and a female in the University of Michigan Museum of Zoology; five males (form I), one male (form

II), five females, and one immature male have been retained in my own collection.

Relationships.—*Cambarus pictus* probably has its closest affinities with *C. pubescens*. The following characters are common to both of these species: A broad, short areola; a long, slender antennal scale; a single well-developed lateral spine on the carapace; a long acumen on the rostrum; a telson with three or four spines in the postero-lateral corners of the anterior sections; and similar hooks on the ischiopodites of both the third and fourth pereopods. Accompanying these similarities is the striking resemblance in the first pleopods of the males.

Despite these close similarities, the males of the two species may be separated by differences in the terminal processes of the first pleopods. In the females of *Cambarus pubescens* the portion of the sternum immediately anterior to the annulus is modified into paired prominences, arising on each side of the midventral line and extending posteriorly and ventrally toward the annulus, whereas the sternum of *C. pictus* in this region is practically plane. Differences in the chelae of both sexes are also noticeable.

LITERATURE CITED

FAXON, WALTER.

1898. Observations on the Astacidae in the United States National Museum and in the Museum of Comparative Zoölogy, with descriptions of new species. Proc. U. S. Nat. Mus., vol. 20, pp. 643-694, pls. 62-70.

1914. Notes on the crayfishes in the United States National Museum and the Museum of Comparative Zoölogy with descriptions of new species and subspecies to which is appended a catalogue of the known species and subspecies. Mem. Mus. Comp. Zoöl., vol. 40, No. 8, pp. 351-427, pls. 1-13.

HARRIS, J. ARTHUR.

1903. An ecological catalogue of the crayfishes belonging to the genus *Cambarus*. Kansas Univ. Sci. Bull., vol. 2, No. 3 (whole series vol. 12, No. 3), pp. 51-187, pls. 1-5.

HOBBS, HORTON H., JR.

1938. Two new crayfishes from Florida. Proc. Florida Acad. Sci., vol. 2, pp. 90-91.

LÖNNBERG, EINAR.

- 1894a. Cambarids from Florida, a new blind species. Zool. Anz., vol. 17, No. 444, pp. 125-127.

- 1894b. Cambarids from Florida. A new blind species, *Cambarus acherontis* mihi. Bihang Svenska Vet.-Akad. Handl., vol. 20, Afd. 4, No. 1, pp. 3-14, 1 pl.

ORTMANN, ARNOLD EDWARD.

1902. The geographical distribution of freshwater decapods and its bearing upon ancient geography. Proc. Amer. Philos. Soc., vol. 41, No. 171, pp. 267-400, figs. 1-8.

1905. The mutual affinities of the species of the genus *Cambarus*, and their dispersal over the United States. Proc. Amer. Philos. Soc., vol. 44, No. 180, pp. 91-136, pl. 3.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1940

No. 3098

ECHINODERMS FROM GREENLAND COLLECTED BY CAPT. ROBERT A. BARTLETT

By AUSTIN H. CLARK

For some years past Capt. Robert A. Bartlett on his annual cruise to the waters about Greenland has paid especial attention to the echinoderms, bringing back extensive and valuable collections. A report upon the collections received prior to 1936 has already been published (Journ. Washington Acad. Sci., vol. 26, pp. 294-296, figs. 1-4, July 15, 1936). The present report covers the material received since that date—909 specimens representing 18 species.

Most remarkable and unexpected of the species represented is a new *Leptasterias* belonging to the subgenus *Hexasterias*, which, except for the large *L. polaris*, was heretofore known only from the north Pacific. Almost equally noteworthy are 5 specimens of the little-known *Crossaster squamatus* from both eastern and north-western Greenland.

The 18 species in the present collection are the following:

Ophiacantha bidentata.
Amphiura sundevalli.
Ophiopholis aculeata.
Ophiura sarsii.
Ophiura robusta.
Ophiocten sericeum.
Pteraster militaris.
Henricia sanguinolenta.
Crossaster squamatus.

Leptasterias bartletti, new species.
Leptasterias groenlandica.
Leptasterias sp.
Stephanasterias albula.
Poliometra proliza.
Heliometra glacialis.
Strongylocentrotus dröbachiensis.
Cucumaria frondosa.
Myriotrochus rinkii.

LOCALITIES

WESTERN GREENLAND

I. Cairn Point, within 5 miles of the Arctic ice pack; rocky bottom; July 30, 1937.

II. Littleton Island, McGorey Island, Smith Sound Harbor; washings from kelp; July 30, 1937.

III. Between Cape Alexander and Cape Chalon; 25-40 fathoms; rocky bottom; August 2, 1938.

IV. Pandora Harbor, near Cape Alexander; August 5, 1937.

V. Off Sutherland Island (Inglefield), Smith Sound, near Cape Alexander; rocky bottom; July 28, 1937.

VI. Northumberland Island; August 7, 1937.

VII. Off Northumberland and Hakluyt Islands (approximately lat. $77^{\circ}28'$ N.); August 8, 1937.

VIII. Whale Sound; rocky bottom; July 28, 1937.

IX. Walrus grounds, Murchison Sound (approximately lat. $77^{\circ}45'$ N.); August 7, 1937.

X. Murchison Sound (approximately lat. $77^{\circ}45'$ N.); 45 fathoms; Rupert Bartlett, August 7, 1938.

XI. Walrus grounds, Murchison Sound (approximately lat. $77^{\circ}42'$ N.); August 7, 1938.

XII. Walrus grounds, Murchison Sound (approximately lat. $77^{\circ}38'$ N.); August 8, 1938.

XIII. Murchison Sound; Hugh Byfield, August 7, 1938.

XIV. Murchison Sound; D. C. Nutt, August 7, 1938.

XV. Oelrich's Bay; muddy bottom; August 6, 1937.

XVI. Conical rock (lat. $76^{\circ}03'$ N., long. $67^{\circ}30'$ W.); 20-40 fathoms; D. C. Nutt and Rupert Bartlett, July 29, 1938.

XVII. Disko Island; muddy bottom; August 16, 1937.

XVIII. Off Prince Christian Sound (lat. $60^{\circ}10'$ N.); 90 fathoms; August 25, 1939.

EASTERN GREENLAND

XIX. Off Cape Farewell; 60-70 fathoms; August 25, 1939.

XX. Off Cape Farewell; 40-100 fathoms; August 25, 1939.

XXI. Off southeastern Greenland (lat. 61° N., long. $42^{\circ}30'$ W.); 80 fathoms; mud and pebbles; August 24, 1939.

XXII. Cape Tattershall, Liverpool coast; Dr. William Province, Jr., July 27, 1936.

XXIII. Booth Harbor, Cape Parry; July 27, 1936.

XXIV. Foster Bay, at the mouth of Francis Joseph fiord; 26 fathoms; Walter W. Kemp, August 2, 1939.

XXV. North fiord; August 2, 1936.

XXVI. North fiord; August 3, 1936.

XXVII. Francis Joseph fiord; August 4, 1936.

XXVIII. Mouth of Grant fiord, Payer Land; 14 fathoms; August 5, 1939.

XXIX. Off Cape Hold-with-Hope; 23-40 fathoms; Walter W. Kemp, August 6, 1939.

XXX. Greenland.

Note.—The catalog numbers of the specimens follow in parentheses the Roman numerals representing the localities.

OPHIUROIDEA

OPHIACANTHA BIDENTATA (Retzius)

Localities.—III (E.5785, E.5808). VI (E.5770). XI (E.5873). XII (E.5843, E.5855, E.5859, E.5860, E.5861). XIX (E.5724, E.5725, E.5726). XX (E.5703, E.5718, E.5719). XXI (E.5712). XXIX (E.5706). Thirty-eight specimens.

AMPHIURA SUNDEVALLI (Müller and Troschel)

Locality.—XX (E.5722). One specimen.

OPHIOPHOLIS ACULEATA (Retzius)

Localities.—III (E.5752, E.5784, E.5805). XII (E.5842). XVI (E.5866, E.5867). XVIII (E.5704, E.5705). XX (E.5701, E.5715, E.5716, E.5717). XXI (E.5713, E.5714). Thirty-six specimens.

Notes.—The largest specimen from locality III has the disk 22 mm. in diameter and the arms 95 mm. long; there are eight arm spines proximally.

OPHIURA SARSH Lütken

Localities.—III (E. 5764, E.5804, E.5807). V (E.5742). VI (E.5769). IX (E.5862). XI (E.5868, E.5859). XV (E.5768, E.5777, E.5783, E.5790). XXI (E.5723). Eighteen specimens.

Notes.—One of the specimens from locality V has the disk 25 mm. in diameter.

OPHIURA ROBUSTA (Ayres)

Localities.—I (E.5823). II (E.5761). III (E.5738, E.5739, E.5740, E.5747, E.5748, E.5750, E.5762, E.5763, E.5806, E.5829, E.5830). IV (E.5746). V (E.5741). VI (E.5749, E.5779, E.5780). VIII (E.5831). IX (E.5864, E.5876, E.5879). XI (E.5870, E.5871, E.5877). XII (E.5857, E.5858, E.5875). XV (E.5771, E.5772, E.5773, E.5774, E.5775, E.5776, E.5782, E.5786, E.5787, E.5788, E.5789, E.5791, E.5792, E.5793, E.5796, E.5797, E.5798, E.5800, E.5801, E.5802, E.5811, E.5812, E.5813). XVI (E.5865). XVII (E.5818). XXII (E.5836). XXVII (E.5834). XXIX (E.5708, E.5709). Three hundred and fifty-five specimens.

Notes.—One of the specimens from locality III (E.5739) is 6-rayed.

OPHIOCTEN SERICEUM (Forbes)

Localities.—III (E.5751, E.5819). IV (E.5745). V (E.5743). IX (E.5863). XI (E.5872). XII (E.5856). XXI (E.5711). XXII (E.5838). XXV (E.5840). XXVI (E.5835). XXVII (E.5833, E.5839). XXIX (E.5710). Two hundred and twenty-one specimens.

Notes.—One of the two specimens from locality V (E.5743) has the disk 18 mm. in diameter and the arms about 35 mm. long.

ASTEROIDEA

PTERASTER MILITARIS (O. F. Müller)

Localities.—I (E.5816). IX (E.5850). Two specimens.

Notes.—The specimen from locality IX (E.5850) has $R=50$ mm., $r=20$ mm.

HENRICIA SANGUINOLENTA (O. F. Müller)

Locality.—XX (E.5721). One specimen.

CROSSASTER SQUAMATUS (Döderlein)

PLATE 58

Localities.—III (E.5828). IX (E.5848, E.5849). XII (E.5851). XXIV (E.5702). Five specimens.

Notes.—In one of the specimens from locality IX (E. 5848) the rays are 10 in number; $R=55$ mm., $r=23$ mm. The abactinal skeleton is a wide-meshed reticulation of narrow bands in the interspaces of which are isolated rounded noncontiguous plates of various sizes. All the plates except the smallest bear spines, those on the smaller plates arising from slight elevations, those on the larger plates arising from high stout elevations with a hemispherical summit. The best developed paxillae have a central group of 13–15 long spines up to 4.3 mm. in length surrounded by a single or partially double row of 25–31 much shorter spines webbed at the base; a few spines of intermediate length are usually present. There are all gradations between these large paxillae and the paired or single small spines of the small plates. As the paxillae become smaller the long central spines decrease in length and stoutness and approach the peripheral spines in character. In a typical small paxilla there are 12–15 spines, the longest not more than one-third as long as the longest spines of the large paxillae, all of the same character, evenly graduated, the longest central about twice as long

as the shortest peripheral. The great variation in the size of the paxillae gives the abactinal surface a curious appearance. The spines on the inferomarginal plates are up to 4.5 mm. in length.

In the second specimen from locality IX (E. 5849) there are 10 rays; $R=50$ mm., $r=20$ mm. This specimen resembles the preceding. In the central portion of the abactinal surface the plates, larger and smaller, are more or less evenly spaced over the surface, no reticulate arrangement being discernible, and the paxillae are mainly of two sizes, large and intermediate, most of them the latter. On the outer half of the disk and on the arms there is a regular very open reticulation of narrow bands with isolated and scattered small plates in the interstices. Here the paxillae are more definitely differentiated into larger and much smaller, the latter on the bands between the larger and on the isolated plates in the interspaces.

In the specimen from locality XII (E. 5851) there are 10 rays, one of them only half grown; $R=16$ mm., $r=7$ mm. The abactinal skeleton is reticulate with large interspaces, which become larger on the arms. Within these interspaces are rounded isolated plates of various sizes, usually one or two, sometimes a few more, in an interspace. When small these plates are merely rounded calcareous nodules; when larger they bear according to size one to six long slender spines resembling those of the paxillae but shorter and slenderer. The paxillae bear 7–20 (most commonly 10–15) long slender spines of which the central five are much longer and stouter than the peripheral and are serrate in the outer half; the large central spines intergrade with the very short and slender peripheral.

In the specimen from locality XXIV (E. 5702) (see pl. 58) there are 11 rather slender rays; $R=60$ mm., $r=25$ mm. The abactinal skeleton is composed of a great number of small plates of various sizes, evenly rounded or with broadly rounded angles, that are contiguous or more or less strongly overlapping, forming an almost complete investment. On the disk there is no suggestion of a reticulate arrangement, but on the rays the plates tend to group themselves in a close-meshed reticulation with four to six smaller plates radiating from the periphery of the larger paxilla-bearing plates. Along the sides of the arms there is a tendency for the plates to become arranged in irregular transverse bands, paxilla-bearing plates being connected by single plates without paxillae. The smaller plates gradually become less numerous, and in the outer portion of the arms only evenly distributed, almost or quite contiguous, paxilla-bearing plates remain. The larger plates on the abactinal surface bear paxillae consisting of a high rounded boss bearing 5–10 (usually 7–9) long spines 1.7 mm. in length. These spines are commonly subequal, but a few of the peripheral may be shorter than the central. Some

of the smaller plates may bear one to five shorter and slenderer spines, and a few may bear as many as 15 spines. Going out along the arms the number of spines in the paxillae gradually decreases until, near the arm tips, the paxillae bear only one to three spines, and still further out only one or two.

Crossaster squamatus is probably only an extreme form of the widespread and very variable *C. papposus*, in spite of the fact that its general appearance is very different.

LEPTASTERIAS (HEXASTERIAS) BARTLETTI, new species

PLATE 59

Description.—Arms 6; R=25 mm.; r= 8 mm. The abactinal skeleton is irregularly and evenly reticulate with no indication of a carinal series of plates, the papular areas small and often containing small, isolated, rounded plates. The area occupied by the plates is of about the same size as, or perhaps greater than, that occupied by the papular areas. Just above the row of superomarginals there is a regular row of rather large papular areas (the supramarginal groove) resembling those in the row between the superomarginals and inferomarginals (the intermarginal groove). A row of actinal plates, which at first are as large as the inferomarginals but rapidly decrease in size, extends to about the middle of the arm.

The abactinal spinelets are numerous, one to five or even six (usually one, two, or three) to a plate. They are small and short, two to four (usually about three) times as long as broad, cylindrical with roundly truncate, spinous, and often striate, tips. The variation in length and slenderness is relatively slight so that the entire aboral surface presents a uniform covering of fine short spines.

The superomarginal spines are somewhat longer and stouter than the abactinal spines, though of the same character. There is usually one to a plate, though sometimes in the middle of the arm this is accompanied by one or even two smaller and slenderer ones. The inferomarginals bear spines resembling those of the superomarginals though slightly larger and stouter and slightly curved distally. There is usually one to a plate, but in the middle of the arm often two are present. There is a row of 9–11 actinal spines, one on each plate. These at first resemble the spines on the inferomarginals but outwardly decrease in size and disappear at about the middle of the arm.

The adambulacral plates each bear two spines, which are slenderer than those on the inferomarginals, though of about the same length; the inner spine, at the furrow edge, is slenderer and slightly longer than the outer. The pairs of spines on successive plates are alternately nearer to and farther away from the furrow.

The mouth plates bear three long spines of which the two outermost are subequal and the innermost, at the apex of the plate, is shorter and slenderer.

On the abactinal surface each spine bears one to four (usually two or three) small crossed pedicellariae, and others occur here and there on the plates between the spines. The superomarginal spines bear one to nine (commonly four to six) pedicellariae in a circle at about the middle. The inferomarginal spines bear one to five (commonly three or four) pedicellariae, which are more or less confined to the side toward the arm tip. The spines on the actinal plates carry usually two or three pedicellariae, mainly on the side away from the furrow. The spines on the adambulacral plates are mostly without pedicellariae, though many carry one, situated usually at or near the base. Each adambulacral plate bears a straight pedicellaria situated within the groove at a little distance below the base of the inner spine. These pedicellariae alternate higher and lower along the groove.

Crossed pedicellariae are numerous abactinally and laterally. Straight pedicellariae occur within the ambulacral groove, on and among the adambulacral spines, in the interradiar areas, and on the abactinal surface of the disk where they are attached to the plates. They are all small. The largest are in the interradiar areas and on the abactinal surface of the disk where, however, they are not numerous.

The crossed pedicellariae have the proximal half of the jaw narrow and the distal half abruptly expanded with a smooth semicircular distal edge, giving somewhat the impression of a horse's hoof. The basal portion, approximately at right angles to the jaw, is somewhat longer than the latter, measuring from the constriction between the two portions.

Viewed from the interior the valves of the straight pedicellariae are seen to have the sides parallel for the proximal two-thirds, thence curving to an oval more or less broad tip. The sides may be smooth or finely serrate, and the tip may be smooth or with the center turned inward and produced into a point.

Locality.—Between Cape Alexander and Cape Chalon, northwestern Greenland; 25–40 fathoms; rocky bottom; Capt. Robert A. Bartlett, August 2, 1937 (type, U.S.N.M. No. E.5753).

Notes.—This species belongs to the *Camtschatica* section of the subgenus *Hewasterias*, typified by *L. (H.) camtschatica*, which heretofore was known only from the coasts bordering the north Pacific and the southern Bering Sea. It is not very closely related to any of the north Pacific or Bering Sea species.

It is easily distinguished from *L. polaris* of the same size. The abactinal spines are cylindrical, not more or less capitate as in

L. polaris. The spines are paired on practically all the adambulacral plates, not alternating two and one as is usual in small *L. polaris*, and these spines are slightly longer than the inferomarginal spines instead of slightly shorter as is the case in *L. polaris*. The row of furrow pedicellariae seen in *L. bartletti* does not occur in *L. polaris*. The crossed pedicellariae are more expanded distally, and the straight pedicellariae are markedly longer than those of *L. polaris*.

From *L. groenlandica* it is easily distinguished, aside from the larger number of arms, by the irregular and close-meshed skeleton and the abundant abactinal pedicellariae, especially on the disk, as well as by the double adambulacral spines.

In addition to numerous 5-armed specimens of *L. groenlandica* there is at hand for comparison one with six arms from Etah, Greenland, collected by Walter Koelz on August 2, 1925 (U.S.N.M. No. E.1251).

LEPTASTERIAS (LEPTASTERIAS) GROENLANDICA (Lütken)

Localities.—II (E.5760). XV (E.5744, E.5799, E.5803). XX (E.5720). Six specimens.

LEPTASTERIAS (LEPTASTERIAS) species

Locality.—VI (E.5832). One specimen.

Note.—This specimen is too young for definite determination.

STEPHANASTERIAS ALBULA (Stimpson)

Localities.—II (E.5759). III (E.5756, E.5767, E.5809, E.5817). IV (E.5755). XI (E.5847). XII (E.5846, E.5854, E.5874). Fifty-nine specimens.

Notes.—The largest specimens, in which $R=25$ mm., are from localities XI (E.5847) and XII (E.5846). From these two localities there are three specimens with seven rays.

CRINOIDEA

POLIOMETRA PROLIXA (Sladen)

Locality.—XXI (E.5736). Three specimens.

HELIOMETRA GLACIALIS (Leach)

Localities.—III (E. 5758, E.5815, E.5825). VII (E.5843). VIII (E.5814). IX (E.5844). XI (E.5845). XII (E.5841, E.5842). XIX (E.5729). XXI (E.5735). Thirty-nine specimens.

Note.—The largest specimens, with arms up to 230 mm. in length, are from localities IX and XI.

ECHINOIDEA

STRONGYLOCENTROTUS DRÖBACHIENSIS (O. F. Müller)

Localities.—I (E. 5822). III (E. 5737, E. 5754, E. 5757, E. 5766, E. 5781, E. 5810, E. 5820, E. 5821, E. 5826). VIII (E. 5824). X (E. 5878, E. 5880). XV (E. 5778). XIX (E. 5730). XX (E. 5731, E. 5732). XXII (E. 5836). XXVIII (E. 5734). XXIX (E. 5707). One hundred and eight specimens.

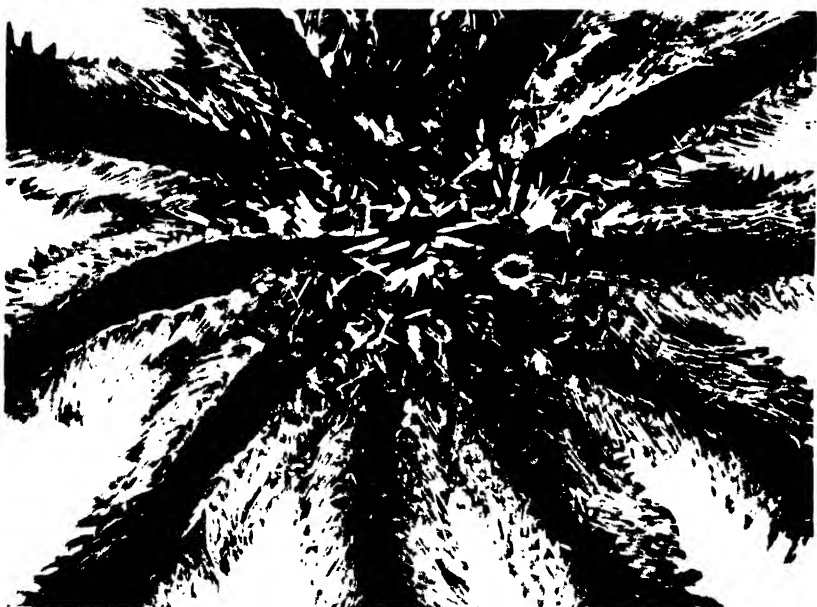
HOLOTHUROIDEA

CUCUMARIA FRONDOSA (Gunnerus)

Localities.—III (E. 5885). X (E. 5882). XI (E. 5881). XIII (E. 5884). XIV (E. 5883). XXI (E. 5733). Six specimens.

MYRIOTROCHUS RINKII (Steenstrup)

Localities.—VI (E. 5888, E. 5889). XXIII (E. 5890). XXVI (E. 5887). XXVII (E. 5886, E. 5891). Nine specimens.



CROSSASTER SQUAMATUS (DÖDERLEIN).

Aboral (upper) and oral (lower) sides. $\times 2$.



LEPTASTERIAS (HEXASTERIAS) BARTLETTI, NEW SPECIES

Aboral (upper) and oral (lower) sides; arm at right cleaned to show skeletal structure $\times 2$.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3099

A REVISION OF THE KEYHOLE URCHINS (MELLITA)

By HUBERT LYMAN CLARK

Several months ago my good friend Austin Hobart Clark, of the United States National Museum, called my attention to a series of *Mellit*as in the national collection that offered some problems in identification. He kindly asked me to make a critical study of the material and subsequently sent it to Cambridge. For this favor I am sincerely grateful and offer Mr. Clark my hearty thanks.

Supplementing this most interesting lot with the large series of specimens in the Museum of Comparative Zoology has enabled me to segregate some new forms and to reach some conclusions as to the composition of the genus that are apparently nearer the truth than those hitherto generally held.

In 1921 Lambert and Thiéry in their "Essai de Nomenclature Raisonnée des Echinides" (fasc. 5, p. 324) revived the name *Leodia* (Gray, 1851) for the species of *Mellita* having six lunules. In view of the facts that a fifth lunule is present in ambulacrum III and that the ambulacral lunules do not originate as in *Mellita quinquesperforata* by the closing up of marginal notches but by resorption of the test through orally developing pits, this action is amply justified.

Leodia is apparently monotypic so far as Recent species are concerned, with *sexiesperforata* Leske of the West Indian region as the only valid species. There is an upper Miocene species, *caroliniana* (Ravenel), that is apparently distinct from *sexiesperforata*, but the Recent species *erythrea* Gray and *pacifica* Verrill are of dubious validity. Gray's species is based on specimens of *sexiesperforata*

said to be from the Red Sea—which is too improbable for belief. Verrill's species has never been rediscovered and probably rests on a young *Encope*. It is odd that Lambert and Thiéry, after reviving the genus *Leodia* for species with six lunules, put *caroliniana*, *erythrea*, and *pacifica* in *Mellita*, which they distinctly say is characterized by "cinq lunules."

The genus *Mellita*, restricted thus to those forms having five lunules, four ambulacral and one interambulacral, contains but few species, of which the type, *quinquiesperforata* (Leske), also well known as *pentapora* (Gmelin) and *testudinata* Klein (or, more correctly, Agassiz), is much the best known. Lambert and Thiéry list five others, but as already pointed out three of these are really *Leodias*. Of the other two, *ampla* Holmes, a fossil species from South Carolina, is undoubtedly a synonym of *quinquiesperforata*, but *longifissa* appears to be a valid species confined to the western coast of Central America and Mexico.

Hitherto the name *quinquiesperforata* has been used for all the 5-lunuled *Mellit*as found on the eastern coasts of America from Nantucket to southern Brazil, but the material from the National Museum shows that several quite distinct forms have been included under that long name. After critical study of this material, and of the large series in the Museum of Comparative Zoology, it seems best to recognize two new species and a well-marked variety of *quinquiesperforata*. *Mellita* thus becomes a genus of four species and a variety, which may be distinguished from each other by the following key. It must be constantly borne in mind, however, that the younger the specimen, the less well marked are its characters. Individuals less than 40 mm. in diameter cannot always be positively identified.

KEY TO THE SPECIES AND VARIETIES IN THE GENUS MELLITA

- a*¹. Test more or less circular or pentagonal, its length (100–150 mm. in large adults) nearly equal to its width, often less, but rarely less than 90 percent thereof; apex more or less central, but rarely definitely in front of abactinal system; anterior half of test not markedly thicker than posterior; periproct usually longer than wide, often markedly so; unpaired lunule not very long, about 20 percent of test length.
- b*¹. Test more or less pentagonal, rather stout, the apex tending toward the anterior; periproct little or moderately elongated..... *quinquiesperforata*
- b*². Test nearly or quite circular, light and thin, the apex tending to be posterior; periproct very long and narrow.

quinquiesperforata var. *tenuis*
- a*². Test more or less elliptical, the width greatly exceeding the length (70–98 mm. in large adults); length only 80–90 percent of width; apex anterior, usually very evidently so; anterior

- half of test much thicker than posterior, the slope from margin to apex being usually quite abrupt; periproct commonly more or less circular (except in *longifissa*); unpaired lunule very long, usually 25–40 percent of test length.
- b*¹. Unpaired lunule of interambulacrum 5 long and narrow, 25 to 40 percent of test length, its breadth less than 10 percent of its length; ambulacral intermediate areas I and V on oral surface long and narrow, greatest width less than 40 percent of length; periproct much longer than wide----- *longifissa*
- b*². Unpaired lunule usually less than 30 percent of test length, its breadth 15 to 20 percent of its length or more; ambulacral intermediate areas I and V on oral surface with their greatest width more than 40 percent of length; periproct more nearly circular.
- c*¹. Ambulacral intermediate areas on oral surface notably wide, in II and IV the width is more than half the length; heads of the minute, capitate, dorsal primaries of nominal size; length of test 85 to 91 percent of width----- *latiarabulacra*
- c*². Ambulacral intermediate areas on oral surface not unusually wide, in II and IV the width is less than half the length; heads of the minute dorsal primaries much enlarged; length of test 80 to 85 percent of the width----- *lata*

The new forms diagnosed in the above key may be described as follows:

Genus MELLITA Agassiz

MELLITA LATA,¹ new species

PLATE 60, FIGURE 1; PLATE 61, FIGURE 1; PLATE 62, FIGURES 1, 2

Test rather stout, especially anteriorly, 70 mm. long by 87 mm. wide and 8 mm. high at apex, 20 mm. back of the anterior margin; posterior margin only 2 mm. thick; the slope up from anterior margin to apex is somewhat abrupt. Center of abactinal system back of apex, 32 mm. from anterior margin; genital pores four. Petaloid areas 44 mm. long and about 42 mm. wide; unpaired petal (III) 18 mm. long (from ocular pore to tip) by 10 mm. wide, narrowed at tip but not closed; petals II and IV, 17 by 12 mm., widest distal to middle, narrowly open, the interporiferous areas curved backward a trifle as if to join the anterior lunules; petals I and V, 22 by 12 mm., widest near the narrowly open tip. All petals very blunt. Lunules II and IV about 20 mm. long by 2 mm. wide, distinctly curved with the concavity anterior; lunules I and V a little shorter, wider, and less curved; unpaired lunule 24 mm. long and more than 3 mm. wide, reaching to within 7 mm. of the posterior margin of the test. Periproct about 3 mm. long by 2.5 mm. wide, its anterior margin 3 mm. posterior to the rear margin of the

¹ *Latus* = broad, in reference to the extraordinary width of this species.

peristome, which is nearly as wide as long. Ambulacral plates form five small knobs, which project rather conspicuously over the peristome, more noticeably than in the other species of the genus. Ambulacral furrows of lower surface conspicuous, the intermediate area in each ambulacrum not very broad; in II and IV these areas are about 40 mm. long by 15 mm. wide.

Primary spines of the dorsal surface less than 1 mm. long, very slender, but conspicuously and rather abruptly capitate, the heads being noticeably larger than in the other species. Surrounding the lunules and around the margins of the test the primaries are 2 to 3 mm. long, flattened and blunt, not at all capitate; around the lunules, particularly the unpaired one, they are markedly widened at tip. On the oral surface the spines are 4 mm. long, more or less, very slender, and are nearly horizontal in position; in the anterior interambulacra (2 and 3) they point outward, but in 1 and 4 they point inward, while in 5 they point to the lunule or midline. Prolonged search over both the holotype and the equally well preserved paratype failed to reveal even a single pedicellaria.

Color greenish gray above with the margins of the lunules and of the test appearing more silvery, owing to the translucency of the longer spines; the lower surface is definitely brown, except as modified by the silvery spines

Locality.—Near Port Limon, Costa Rica, from "high and dry" on the sand beach; George T. Kenley, collector.

Holotype.—U.S.N.M. No. E. 5655.

Notes.—Besides the holotype there are two paratypes taken at the same time and place by Mr. Kenley. The larger is 60 mm. long, 72 mm. wide, and 6.5 mm. high. The form of the test and general appearance are exactly as in the holotype, except that the color is distinctly brown on both surfaces. Under a lens the large, flat, broad-tipped spines bordering the unpaired lunule show clearly a fundamental green-gray color (as in the holotype) slightly tinted with brown. As this specimen was taken in about 3 feet of water, it is not unlikely that the normal color of *lata* is brown and the greenish gray of the dorsal surface of the holotype is due to bleaching while "high and dry" on the beach.

The third specimen from Port Limon is a bare and defective test 59 by 71 mm. showing no notable peculiarities.

There are also in the National Museum material two small bare tests, which, in spite of their obvious immaturity, may yet be considered paratypes. The larger is 48 by 58 by 7 mm. and is thus relatively high, while the anterior upward slope of the test is more abrupt than in any other specimen. The smaller is 40 by 44 by 4.5 mm., the length and breadth being more nearly equal than in adults.

These two bare tests are from La Mancha, Veracruz, Mexico, and are the gift of A. L. Herrera.

In the Museum of Comparative Zoology there are three specimens of this species, but unfortunately they have no label to show their origin. They have been in the collection for at least 70 years and are labeled *Mellita quinquesperforata* and (from early years) *Mellita testudinata*. The largest is nearly bare but retains a band of the conspicuously capitate primary spines around the posterior margin, dorsally. It is 64 by 74 by 6.5 mm. but is curiously deformed in the anterior left quadrant; petal IV is only 14 mm. long, while II is 21 mm., and lunule IV is only 11 mm. long, while II is 14 mm.; there are two genital pores in interambulacrum 2. The second specimen is smaller 60 by 68 by 7 mm., but is a fine, symmetrical, bare test. The smallest is only 38 by 44 by 4 mm. and still retains its covering of spines, but they are matted together by some sort of adhering and long-since dried slime. Although the origin of these specimens is unknown, they are clearly to be referred to *lata* and are hence considered paratypes.

Typical examples of this species are unmistakable, for aside from the excessive width the anterior position of the apex is a striking feature, and the large "heads" of the dorsal primary spines give a texture to the upper surface of well-preserved specimens that is different from the other species of *Mellita*.

As yet *lata* is known only from the eastern coast of Costa Rica and southern Mexico. How far to the north or south it ranges we can only guess, but it apparently does not reach either Texas or Venezuela, as the *Mellit*as at hand from those coasts are not *lata*. However, it must be admitted that no *Mellit*as from southern Texas or western Venezuela are as yet known.

MELLITA LATIAMBULACRA,² new species

PLATE 62, FIGURES 3-6

Description.—Test moderately thick, 99 mm. long, 106 mm. wide, and 10 mm. high at apex, 40 mm. from the anterior margin, which is 2 mm. thick, the posterior margin being little more than half as much. The slope up from anterior margin is rather gradual. Abactinal system very close to apex, but slightly posterior; genital pores four. Petaloid area large, about 60 mm. long by 55 mm. wide; unpaired petal (from ocular pore to tip) 27 mm. long by 15 mm. wide, narrowed at tip, but not closed; petals II and IV, 28 by 14 mm. a little distal to middle, narrowly open, the interporiferous areas

² *Latus* = broad + ambulacra, in reference to the very wide, oral, ambulacral, intermediate areas.

quite straight; petals I and V, 34 by 17 mm., widest at or very near the tip and well open there. All petals blunt, the posterior pair being almost truncate. Lunules II and IV about 18 mm. long by 3 mm. wide, nearly or quite straight although the posterior margin may be concave; lunules I and V similar, a trifle shorter but about the same width; unpaired lunule long and nearly straight, about 30 mm. long by 4.5 mm. wide, reaching to within 13 mm. of the disk margin. Periproct about 4.5 mm. long by 2.5 mm. wide, its anterior margin scarcely 4 mm. from the margin of the peristome, which is about 4 mm. in diameter, rounded-pentagonal, the ambulacral knobs on the margin relatively low and inconspicuous. Ambulacral furrows of lower surface conspicuous, the intermediate areas in each ambulacrum being notably wide; in II and IV these areas are 45 mm. long and 24 mm. across where widest.

Primary spines of dorsal surface less than 1 mm. long, very slender and abruptly capitate; but the heads are relatively small when compared with those of *M. lata*; they are distinctly larger than in *M. quinquiesperforata*. Surrounding the lunules and around the margin of the test the primaries are 2-3 mm. long, flattened and blunt, not at all capitate; around the lunules, particularly the unpaired one, they are widened at the tip but not so conspicuously as in *lata*. On the oral surface the primaries are as in other *Mellit*as, 3-4 mm. long, very slender, more or less horizontal in position, and arranged so that in any given area they all point in the same direction. No pedicellariae have been found.

In color the holotype is light brown with a grayish tint abactinally, more reddish brown on the oral surface.

Locality.—Cumaná, Venezuela; Captain Couthouy, 1859.

Holotype.—M.C.Z. No. 246.

Notes.—There are two paratypes from Cumaná, but they are perfectly bare though not at all bleached; the larger is 94 by 109 by 10 mm., with the apex only about 30 mm. from the anterior margin; the oral ambulacral area IV is 43 by 22 mm.; the color is brown, with the aboral side unevenly tinted with violet or greenish. The smaller specimen is 88 by 96 by 10 mm., with the apex about 35 mm. back; oral ambulacral area IV is 41 by 24 mm., and the upper surface has a distinctly greenish cast.

There are additional paratypes in the Museum of Comparative Zoology. One from Manzanilla Beach, east coast of Trinidad, 68 by 78 by 8 mm., has the apex a little more than 20 mm. back and the oral ambulacral areas II and IV, 34 by 20 mm.; the color above is dull greenish, orally brown. From Mayaro Bay, east coast of Trinidad, there are four small nearly bare specimens, one of which is notable for its relatively long, narrow form, 57 by 63 mm.; while the others

are 49–52 by 57–62 mm. From Bahia, Brazil, there are two bare half-grown tests, one of which is in fragments. From Itabapuana, Brazil, there are nine bare tests of young individuals, 37 by 42 mm. up to 59 by 68 mm., the smallest with the apex very high (6 mm.) and far back (16 mm.), and the posterior lunules I and IV are still open at the margin. From off Barbados in 100 fathoms there is a very young individual collected by *The Hassler*, 12 by 13 mm. with the paired lunules indicated only by slight notches in the test margin while the oral ambulacral areas II and IV are little more than 4 mm. long, and their distal width is nearly 3 mm.

In the lot of *Mellita* from the United States National Museum there are seven specimens to be referred to this species, and though all are young they are quite typical and are to be considered paratypes. The largest is a bare and water-worn test 57 mm. long by 65 mm. wide, with the apex 6 mm. high and 23 mm. back of the margin. It is said to be from the coast of the State of São Paulo, Brazil. From Itajahy, Brazil, are five young specimens, three of which are notable for having retained most of their spines; the general color is a light greenish gray, but the oral ambulacral areas are more or less violet-brown in rather noticeable contrast; areas II and IV are conspicuously wide, 22 by 13 mm. in the largest specimen, which is 48 by 55 by 4.5 mm.; the smallest is only 42 by 45 mm. The bare tests are also small individuals, and the larger is notable for its pale blue-green color. From the beach at Santos, Brazil, is a young bare test 43 by 40 mm., with the oral ambulacral areas II and IV scarcely 20 mm. long though fully 11 mm. wide.

Even extreme examples of this species do not equal the wide proportions of *lata*, but they do exceed the widest *quinquesperforata* available for comparison. In this particular it is probable that no hard and fast specific lines can be drawn, but in the great width of the oral ambulacral intermediate areas, especially in II and IV, a very trustworthy specific character is found. Of course, in young individuals (less than 40 mm. long) it is not so marked as in adults. The great thickness of the anterior half of the test as compared with the posterior is also a useful character, and in mature specimens the great length of the unpaired lunule is a notable feature.

This seems to be the characteristic *Mellita* of Trinidad and the eastern Venezuelan coast. How far the range extends to the west is still to be determined, but southward it seems to include practically the whole coast of Brazil, even to the State of Santa Catherina. The puzzling thing about this vast range is that *quinquesperforata* also seems to occur on the Brazilian coast; at least there are bare tests in the Museum of Comparative Zoology taken by the Thayer expedition at Maranhão that are undoubtedly the

common northern species. But as similar tests are in the Museum of Comparative Zoology from "off Nantucket," whereas the species is not known to *live* farther north than Chesapeake Bay, it may be these bare tests from Maranhão need not be construed as evidence that *quinquiesperforata* really occurs living on the Brazilian coast. Obviously the actual ecological relationships of *latiambulacra* and *quinquiesperforata* are completely obscure.

MELLITA QUINQUIESPERFORATA TENUIS,³ new variety

PLATE 60, FIGURE 2; PLATE 61, FIGURE 2

Description.—Test notably light and thin, very nearly circular but somewhat narrower anteriorly and with slight reentering curves at each end. The diameter along different axes ranges from 103 mm. through III-5 to 109 mm. through I-3, but the usual measurement is about 107 mm. Apex posterior to abactinal system, at or a little posterior to center of test; at that point the test is almost 10 mm. high. The slope from margin to apex is quite uniform and gradual from all sides; the margin in III is barely 2 mm. thick and in 5 it is just 1 mm. Genital pores 4. Petaloid area of moderate size, about 58 mm. long by 55 mm. wide; unpaired petal (ocular pore to tip) 25 mm. long by 14 mm. wide, narrowed at tip and but little open there; petals II and IV 24 by 12 mm., narrowly open, the interporiferous areas quite straight; petals I and V 30 by 15 mm., narrowed at tip and scarcely open there. Lunules strikingly small and straight; II and IV 10 mm. long by 2.5 mm. wide, I and V 11 by 2.5 mm., and the unpaired lunule 18 by 3.5 mm., its posterior end 20 mm. from the test margin. Periproct very long and narrow, 4.5 by 1.25 mm., its anterior margin only 3.5 mm. from the posterior margin of the peristome, which is small, rounded-pentagonal, only 3 mm. in diameter; the ambulacral knobs are small and inconspicuous. Ambulacral furrows of oral surface well marked, but the intermediate areas are rather narrow; in II and IV these areas are 47 mm. long but only 21 mm. in maximum width.

Primary spines of dorsal surface less than 1 mm. long, very slender at base but swollen at the tip into a conspicuous ovoid head about one-third the length of the entire spine. Surrounding the lunules and around the margin of the test the primaries are elongated, narrow, flattened, and blunt, but they are not widened at the tip, rather they may be narrowed. On the oral surface the primaries are slender and elongated and arranged so that they lie almost horizontally and pointing in definite directions, as in the other species of *Mellita*. No pedicellariae have been detected.

³ *Tenuis*—thin, in reference to the texture of the test as compared with that of the species itself.

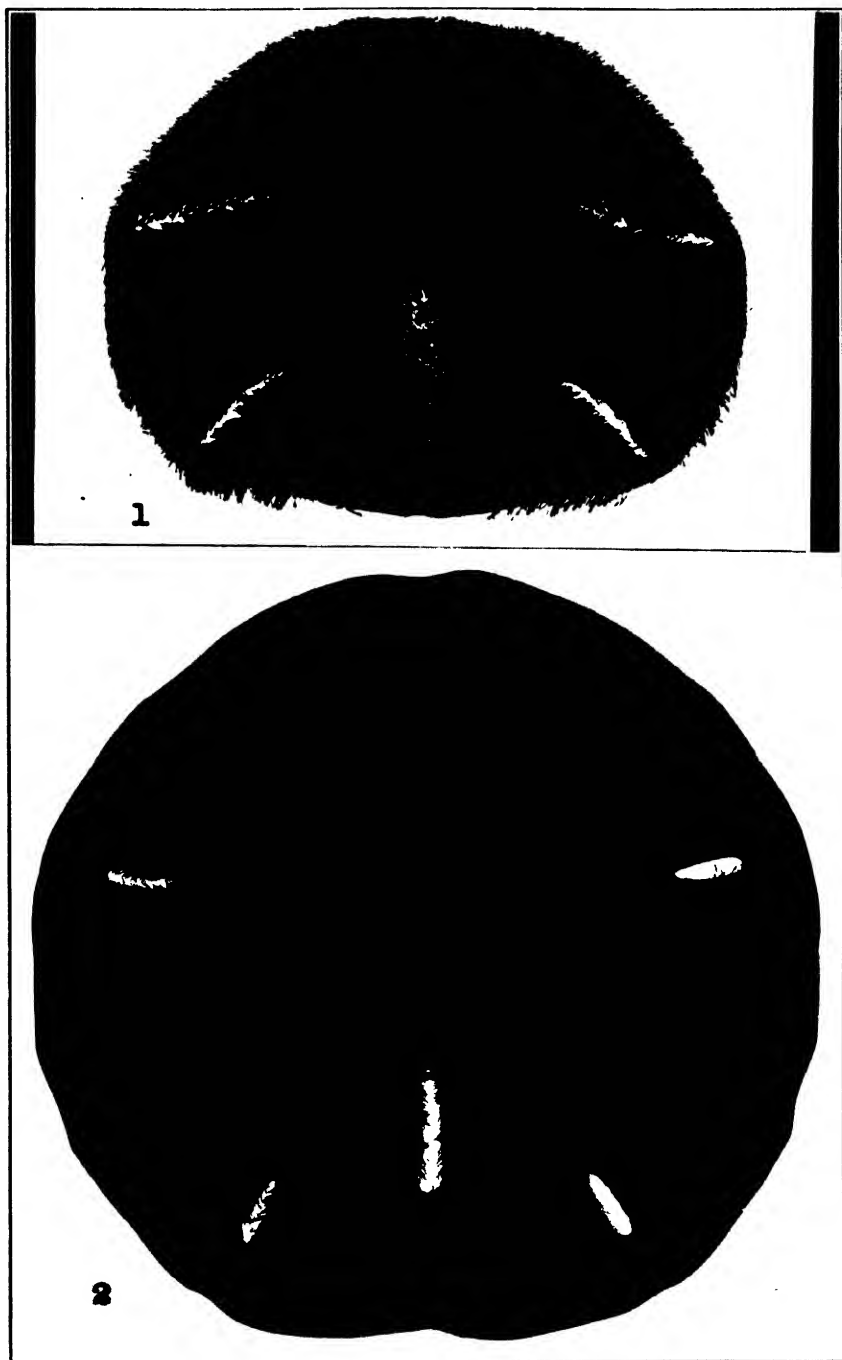
The color is uniformly brown; orally the test is a brighter, more yellowish, brown than on the upper surface.

Locality.—Northwest of lighthouse 2 miles outside of Sanibel Island, Fla., from a sandbar in 3-4 feet of water; W. J. Clench, February 1929.

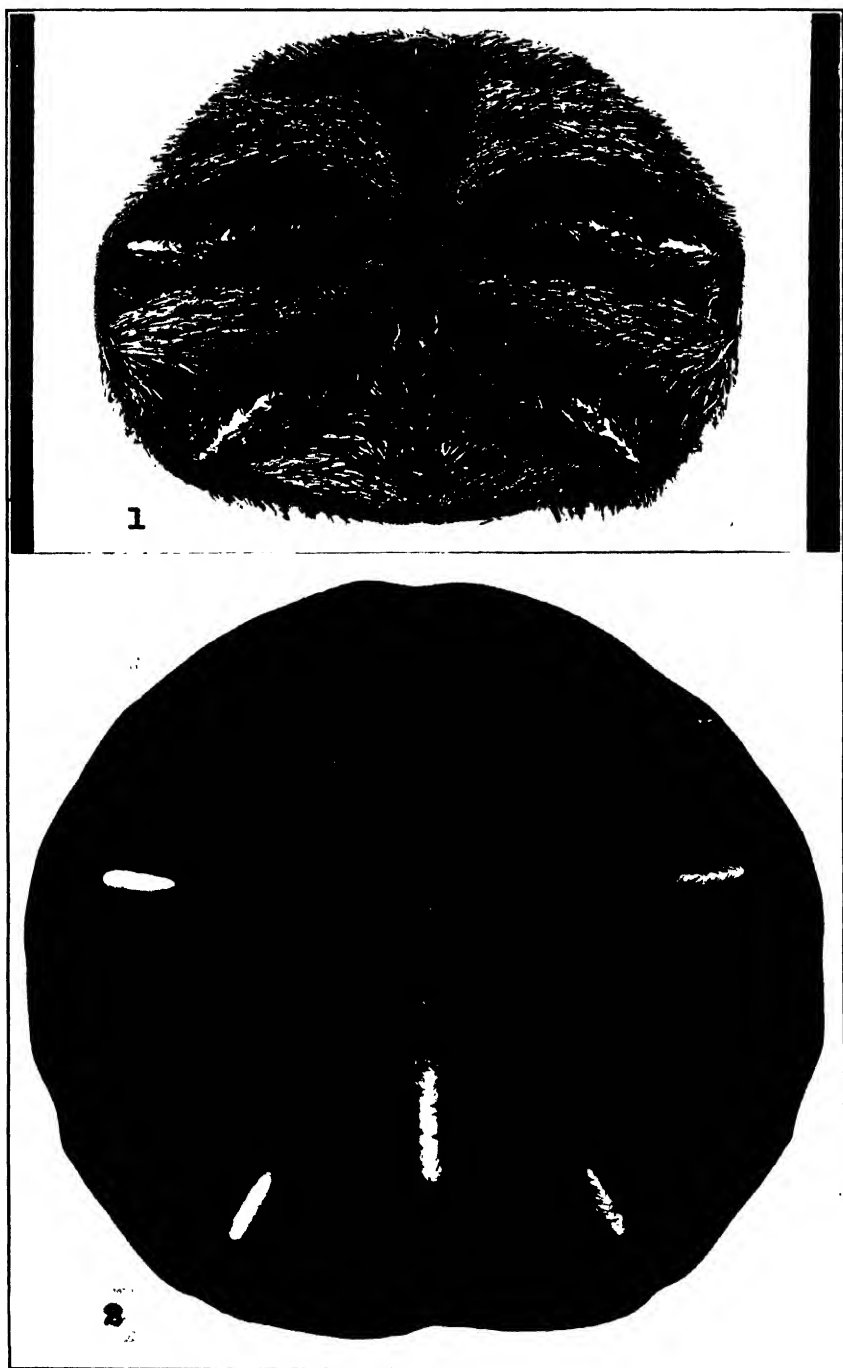
Holotype.—U.S.N.M. No. E.5656.

Notes.—There are in the United States National Museum two paratypes of this variety. The larger is from Tarpon Springs, Fla., where it was collected by Edwin J. Shadle. It is 98 by 102 mm. in diameter and is a lighter and yellower brown than the holotype. The other specimen, collected by Dr. W. H. Dall at Charlotte Harbor, Fla., is almost circular, 55 m. in diameter, and has the apex unusually far back, just in front of the unpaired lunule. The color is like the Tarpon Springs material. In the Museum of Comparative Zoology collection are a number of specimens of this variety from Sanibel Island, Fla., of which half a dozen are paratypes collected with the holotype by Mr. Clench in February 1929. The smallest is only 44 mm. long and almost 44 mm. wide; the test is very thin and delicate, scarcely 3 mm. thick at the apex, which is very close to the center of the test; the color is a deep gray above, light brown beneath, with many light greenish-blue lines and areas, specially near the mouth. The larger specimens are like the holotype in color and range from 74 to 104 mm. in length, with the width the same or a millimeter more or less, except one that is 99 mm. long by 104 mm. wide. In all these specimens the apex of the test is at or behind the center, and the lunules are uniformly small. Besides these specimens the Museum of Comparative Zoology contains, also from Sanibel Island, a bare but not bleached test 120 by 125 mm., a water-worn test 78 by 81 mm., and a very young specimen only 19 mm. in diameter in which the paired lunules are not yet closed in. There are also five small specimens from an unknown locality of which the largest is 71 by 68 mm., with the apex very evidently at the anterior end of the unpaired lunule, while the other specimens, 48-57 mm. long (with width about the same), are rounded pentagonal, more or less asymmetrical, and have the anterior margin notably straight rather than curved. There are also 10 very young *Mellitas*, 23-36 mm. in diameter, dredged half a mile off the eastern end of Sanibel Island in 1-2.5 fathoms by W. J. Clench on April 6, 1933, which are naturally to be considered the young of *tenuis*, although of course in such immature specimens the varietal characters are not conspicuous. But the posterior position of the apex is a fairly distinctive feature. The Museum of Comparative Zoology has also a paratype from Tarpon Springs, Fla., taken by Edwin J. Shadle, 89-93 mm. in diameter, received from the United

States National Museum. Finally, it seems best to refer to this variety three large specimens that Alexander Agassiz collected many years ago at Captiva Key, Fla., near Sanibel Island. These specimens range from 100 by 110 mm. to 129 by 129 mm. and are notably thicker and solidier than typical *tenuis*, and the apex is evidently central or anterior. Such specimens prove that *tenuis* is not a well-defined species yet. But typical examples of this *Mellita* are so conspicuously different from ordinary *quinquiesperforata* that when the Tarpon Springs and Charlotte Harbor specimens were first examined it seemed quite clear that they represented a well-marked species characteristic of the west coast of Florida. The large series available of the common species shows, however, that there are numerous connecting links, and the conclusion was reluctantly reached that *tenuis* must be rated as a variety merely. There are specimens at hand from the Carolina coast that are so similar to those from Sanibel Island that they cannot be distinguished by constant measurable characters. On the other hand, there are the three large specimens from Captiva Key, mentioned above, which are too much like ordinary *quinquiesperforata* to justify specific separation. An interesting point in the matter is that specimens from the coast of Texas and western Louisiana are normal *quinquiesperforata*.

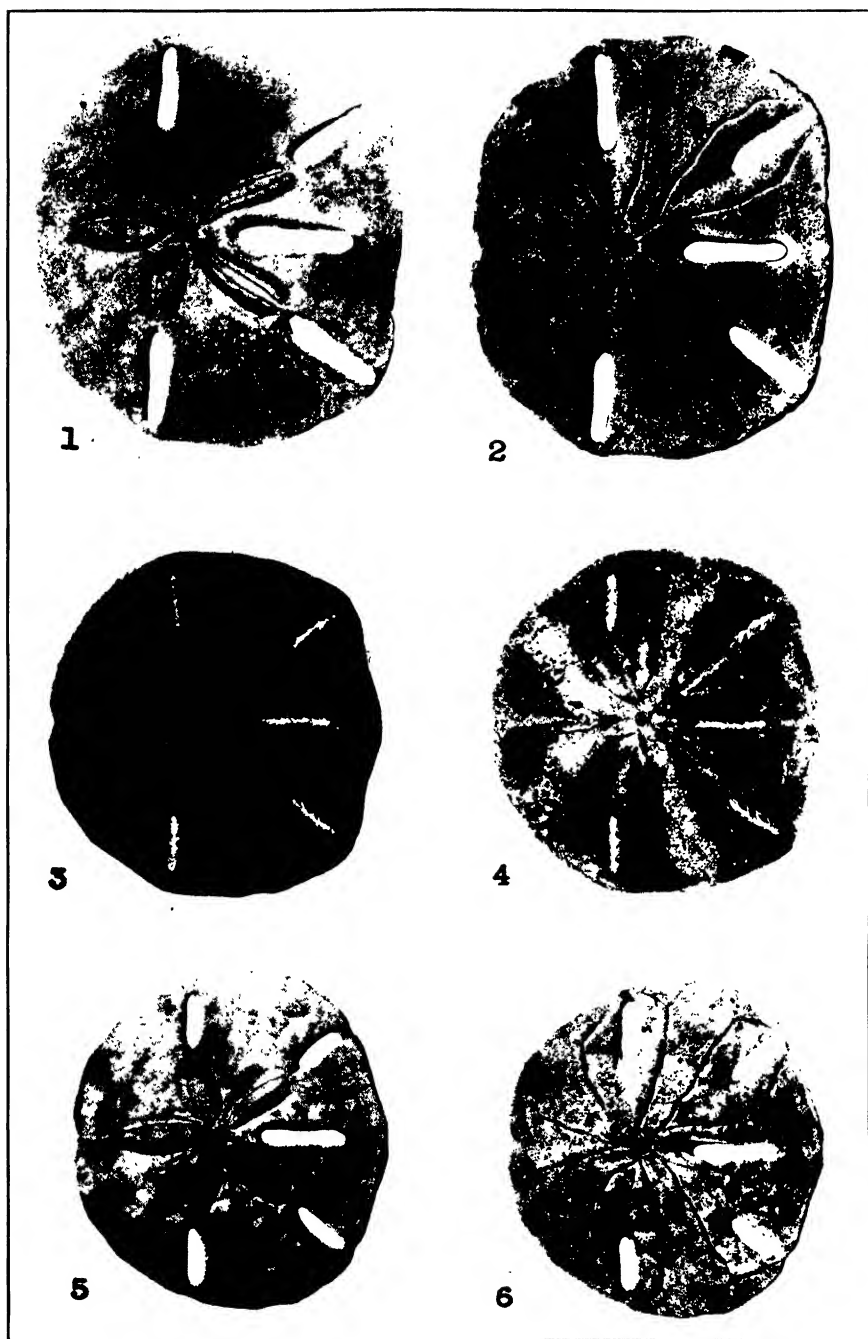


1, *Mellita lata*, new species: Type. Aboral surface. From Port Limon, Costa Rica.
2, *Mellita quinquesperforata tenuis*, new variety: Type. Aboral surface. From Sanibel Island, Fla.



1, *Mellita lata*, new species: Oral surface of specimen shown in pl. 60, fig. 1.

2, *Mellita quinquesperforata tenuis*, new variety: Oral surface of specimen shown in pl. 60, fig. 2.



1, 2, *Mellita lata*, new species: Bare test, aboral and oral surfaces, of small specimen from La Mancha, Veracruz, Mexico.
3-6, *Mellita latambulacra*, new species: Young; 3 and 4 with spines; 5 and 6, bare test. From Santos, Brazil.

PROCEEDINGS OF THE UNITED STATES NATIONAL MUSEUM



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3100

EURHOPTODES, A REMARKABLE NEW GENUS OF
PHILIPPINE CRYPTORHYNCHINE WEEVILS

By ELWOOD C. ZIMMERMAN

THE material upon which this paper is based was sent to me for identification from the United States National Museum by L. L. Buchanan. It has proved to be new and represents an extraordinary genus of cryptorhynchine weevils for which a new name must be proposed.

EURHOPTODES, new genus

Body small, ovoid, dorsally convex, setose, not conspicuously squamose. Head normally concealed from above by the pronotum; interocular area as broad as the base of the rostrum; eyes coarsely faceted, lateral, separated below by the breadth of the base of the rostrum, hidden by the postocular lobes at repose. Rostrum arcuate, dorsoventrally compressed, obviously broader than thick, shorter than the prothorax; antennae inserted slightly beyond the middle, the scrobe lateral, running back to the eye.

Antennae with the scape gradually clavate, about as long as the funiculus excluding the club, its apex not quite attaining the eye; funiculus 7-segmented, the first segment somewhat longer and stouter than the second, the second longer than the third, 3 to 7 moniliform and each successively slightly broader; club ovoid, shorter than the funiculus, the first segment making up half its mass, the sutures not

well marked. Prothorax slightly transverse, subapically constricted; postocular lobes present. Scutellum invisible. Elytra fused, closely embracing the venter, not broader at the extreme base than the base of the prothorax, 9-striate, the ninth stria complete; humeri obsolete. Wings absent.

Legs with the femora shallowly, longitudinally impressed below, armed at about the apical third of the outer edge of the lower surface with a distinct tooth, the hind pair reaching to near the apex of the elytra; tibiae, except for the basal angulation, nearly straight, multicarinate, the uncus so situated as to appear to arise from the inner apical angle, the true inner apical angle bearing a small tooth; tarsi slender, the first segment as long as or longer than 2 plus 3, 2 about as long as broad, about as broad as 1 and slightly larger than 3, 3 small, apically emarginate but not distinctly bilobed, 5 slender and longer than 2 plus 3; claws long and slender.

Sternum with the pectoral canal deep and broad, naked, terminating between the mesocoxae, the walls well formed; the mesosternal receptacle open, but the protuberant hind wall making the receptacle almost cavernous, the high side walls touching the fore coxae; fore coxae separated by about the breadth of a coxa, the distance between the fore and mid coxae only about half the longitudinal diameter of a fore coxa; mesocoxae separated by a distance greater than the breadth of a coxa; metasternum at its narrowest point between the mid and hind coxae narrower than a mesocoxa, metacoxae almost twice as widely separated as the mesocoxae, the metacoxal cavities subcircular in outline and almost touching the elytra.

Venter with the first two ventrites fused, subequal in length at their side margins at the elytra, but the first about twice as long as the second along the median line, the entire disks of the first two segments occupied by a huge, deep, craterlike fovea; ventrites 3 and 4 subequal and together shorter than 5.

Genotype.—*Eurhoptodes cratatus*, new species.

This genus belongs in the *Acalles* complex. At first sight it appears to be congeneric with the American *Eurhoptus* LeConte, 1876, because of its remarkable abdominal crater. *Eurhoptodes* is distinct from *Eurhoptus*, however, because it has dentate femora and distinctly narrower tibiae and tarsi; furthermore the mesosternal receptacle is deeply cavernous on *Eurhoptus*.

For two peculiar genera in such isolated zoogeographical regions, their similarity is remarkable. *Eurhoptus* appears to me to be an obvious offshoot of true *Acalles*. I have seen no other Pacific or Oriental weevils with which *Eurhoptodes* might be associated or confused.

EURHOPTODES CRATATUS, new species

FIGURE 23.

Male: Derm piceous, the appendages more diluted with red; dorsum coarsely reticulate, the granules polished; squamae on the basal margin of the prothorax and sides of the sterna dirty yellowish white; setae yellowish or bronzed; covered with a thin, dirty, amorphous incrustation; without dorsal squamae except at the basal margin of the prothorax.

Head densely, coarsely, subconfluently punctate throughout, some of the punctures bearing slender, erect setae; the longitudinal dorsal outline concave between the crown and base of the rostrum.

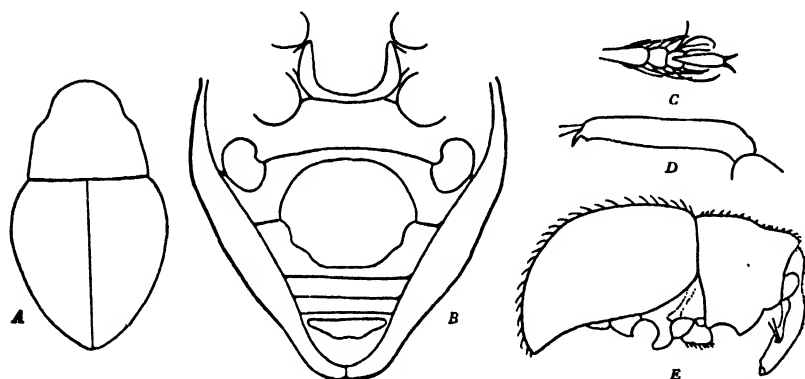


FIGURE 23.—*Eurhoptodes cratatus*, new species: *A*, Dorsal aspect; *B*, venter (the proportions are not all correct here because of foreshortening; see descriptions for correct measurements); *C*, tarsus; *D*, tibia; *E*, side view.

Rostrum as broad at the base as at the apex, hardly narrowed at the antennae (9:8), about two-thirds as long from the ventral, basal angulation to the apex as the prothorax; antennae inserted just beyond the middle in the male (2.2:2); the dorsal margin of the scrobe well defined, slightly sinuous; sculpture coarse and dense to beyond the antennae, with two coarsely punctate grooves between the median line and the scrobe, the median line therefore appearing as a carina.

Antennae with the scape as long as the first six funicular segments, terminating at about the length of the second funicular segment from the eye; funiculus with segment 1 as long as 2 plus 3, 2 not quite so long as 3 plus 4, 3 to 7 subequal in length and each successively broader; club pointed, longer than broad, as long as the preceding five segments

Prothorax about one-seventh broader than long (3.5:2.9), broadest at the extreme base and there slightly broader than across the middle; base subtruncate, but slightly arcuate, the edge bearing small, densely packed squamae; almost straight on the sides from the base to middle,

thence abruptly constricted, the outline thence subsemicircular to the apex, the constriction continued distinctly across the dorsum; sculpture consisting of coarse punctures interspersed with low, polished granules; each puncture bearing a conspicuous, fine, erect seta.

Elytra slightly longer than broad (4.6:4.3), two-fifths longer than the prothorax, broadest at about the basal third; base subtruncate; lateral margins arcuately diverging from the base to apical third, thence rapidly, arcuately converging to the apex; striae shallow, bearing large shallow punctures, broader than the intervals; intervals marked by single rows of well spaced, low, polished granules and single rows of erect, slender, very conspicuous, spikelike setae.

Legs with the femora coarsely and densely punctate, the punctures bearing distinct setae, the hind pair reaching almost to the apex of the elytra, the tooth arising on the outer edge at one-third from the apex, those on the fore pair largest; tibiae slender, the hind pair two-thirds as long as the femora, one-fifth as broad at the middle as long, the punctate grooves between the carinae set with fine, erect setae similar to those on the dorsum; tarsi with dense, long hairs on the under sides of the first three segments, the hair on segments 2 and 3 longer than those segments, some of the hairs longer than both segments together.

Sternum with the mesosternal receptacle terminating on a line between the middles of the mesocoxae; metasternum transversely concave, bearing large, shallow punctures, the sides very densely set with small squamae forming a triangle from the middle of the coxa forward to near the base of the elytra and back to the lateral junction of the metasternum and first ventrite, the shortest distance between the mid and hind coxae only one half the longitudinal diameter of a metacoxa, the metacoxae separated by three times the breadth of a coxa; the suture between the venter and sternum broadly arcuate.

Venter with the longitudinal diameter of the fovea greater than the median length of the remainder of the abdomen plus the apices of the elytra; the distance between the anterior margin of the fovea and the metasternum one third the median length of the metasternum, the distance between the hind margin of the fovea and the third ventrite less than the median length of the third ventrite; the floor of the fovea not obviously punctate, bearing a few long, erect setae; ventrite 5 about twice as long as 3 plus 4, with a deep, arcuate depression in the anterior half.

Length, 1.9 mm.; breadth, 1.1 mm.

Type.—Holotype male (U.S.N.M. No. 53890) collected by C. F. Baker on Mount Makiling, Luzon, Philippine Islands. Unfortunately, I have seen only one specimen of this species.

From the dorsal aspect this small insect resembles a nonsquamose *Acalles*, but it will easily be recognized when the lower surface is examined.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3101

THE POLYCLAD FLATWORMS OF THE ATLANTIC COAST OF THE UNITED STATES AND CANADA

By LIBBIE H. HYMAN

SINCE the work of Girard and Verrill and the one paper by Wheeler in 1894, the polyclads of the Atlantic coast of North America have not been studied until recently, when the subject was simultaneously and independently attacked by Dr. A. S. Pearse, of Duke University, and myself. Pearse and his associates¹ published their work in three papers appearing in rapid succession which antedated my article on some of the same species (Hyman, 1939a). More recently I undertook this revision of all the Atlantic coast material contained in the collections of the United States National Museum, including the polyclads studied by Pearse, Littler, and Walker. Dr. Pearse himself furnished me with two shipments of live polyclads.

In the hope of discovering whole mounts mentioned by Verrill in his account of New England polyclads (1892-93), I made a trip to the Peabody Museum of Yale University and examined large numbers of Verrill's slides. Nothing of value, however, was discovered. Thanks are expressed to M. D. Burkenroad, assistant curator, for time and trouble expended in helping me with these slides.

The work of Pearse and his coworkers was based on whole mounts. These have now been studied in serial section, except in the case of one specimen, of which only the type was available. Unfortunately, Pearse's specimens were found to be in extremely bad histological condition, so that the sections were often unsatisfactory. It has nevertheless been possible to determine the status of practically every species.

¹ Pearse, 1938; Pearse and Littler, 1938; and Pearse and Walker, 1939.

The polyclads of the *Sargassum* are omitted here, as they are considered in full elsewhere (Hyman, 1939b).

Order POLYCLADIDA

Suborder ACOTYLEA²

Definition.—Polyclads without a sucker behind the female genital pore; tentacles when present of the nuchal type; eyes never in paired groups on the anterior margin; pharynx typically ruffled; copulatory complex generally in the posterior body half; uteri extending anterior to the female genital pore (but in a few families the pharynx is tubular and the copulatory complex may then be in the anterior half).

Section CRASPEDOMMATA Bock, 1913

Definition.—Acotylea with a band of eyes along the whole or the anterior part of the body margin; with cerebral and tentacular eye clusters in addition and sometimes also frontal eyes, or anterior end strewn with small eyes not arranged in clusters (eyes completely lacking in *Plehnia arctica*).

Family DISCOCELIDAE Laidlaw, 1903

Definition.—Craspedommata of oval form with marginal band of eyes limited to the anterior body half; tentacles absent; cerebral and tentacular eye clusters present; copulatory complex immediately behind the pharynx; male organ and wall of male antrum with numerous prostatic apparatuses; typical prostatic vesicle absent.

CORONADENA, new genus

Definition.—Discocelidae with a semicircle of 7–11 prostatic apparatuses around the male antrum; otherwise as in *Discocelis*.

CORONADENA MUTABILIS (Verrill, 1873), new combination

FIGURE 24, a, b

Polycelis mutabilis VERRILL, 1873, p. 746.

Discocelis mutabilis VERRILL, 1893, p. 493, pl. 40, fig. 7; pl. 42, figs. 6, 6a, 7.—PEARSE and WALKER, 1939, p. 16, fig. 1.

Discocelis grisea PEARSE, 1938, p. 67, fig. 22.—PEARSE and LITTLE, 1938, p. 235, pl. 20, fig. 1.

Material.—Ten whole mounts in Pearse collection labeled *Discocelis grisea*, including type; set of serial sections made from one of these;

² Pearse spells the names of the suborders Acotylina and Cotylina, in accordance with the terminology proposed by him in his brochure: *Zoological Names, a List of Phyla, Classes, and Orders Prepared for Section F, American Association for the Advancement of Science*, 24 pp., Duke University Press, 1936.

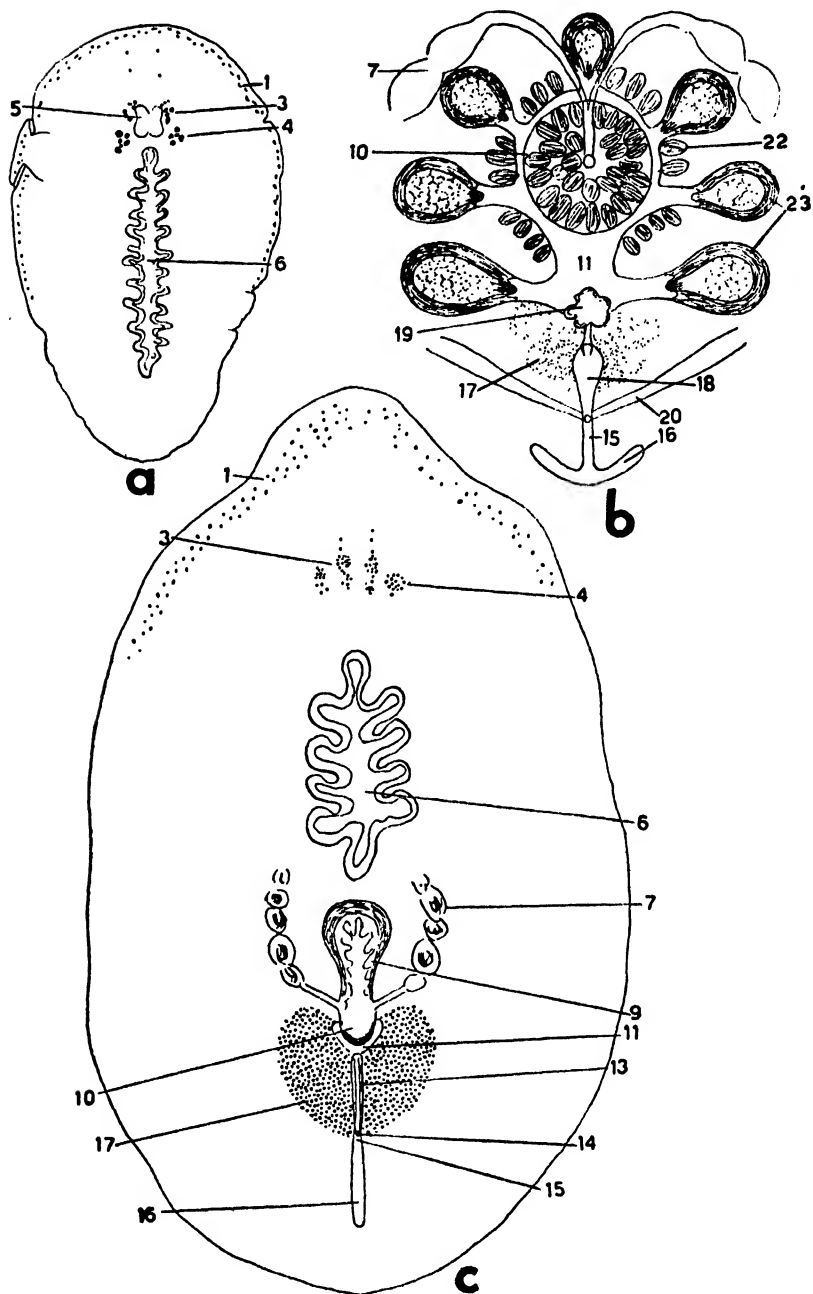


FIGURE 24.—*a*, *Coronadena mutabilis* (Verrill), young specimen, from one of Pearse's whole mounts; *b*, the copulatory complex of *C. mutabilis* viewed from above, constructed with the aid of frontal sections and whole mounts; *c*, *Discocelides ellipsoides* (Girard), from U. S. F. C. slide No. 15621. (See p. 492 for index to numbered parts.)

one specimen in vial in U. S. National Museum material, No. 118/156b, collected in tow off Beaufort, N. C.; serial sections of posterior half of this specimen.

Form.—Oval or slightly oboval (see Pearse, 1938, fig. 22); size moderate, maximum dimensions 18 mm. long, 5 mm. wide, most specimens smaller than this; tentacles absent. Young specimens (fig. 24, a) may be very obovate.

Eyes.—Marginal band of small eyes around anterior half of the body; cerebral and tentacular eyes in four conspicuous clusters; tentacular clusters compact, of about 10–20 eyes each, some large; cerebral clusters looser, more elongate, of 10–25 smaller eyes, often with one or two eyes considerably in advance of the group; without definite frontal eyes. Young specimens (fig. 24, a), with about five eyes in each group, marginal band one or two rows wide.

Color.—Florida specimens gray with faint radiating light streaks; specimens from North Carolina northward yellowish brown or tan with brown speckles.

Digestive tract.—Pharynx central, elongate, ruffled with a number of ruffles of moderate length, mouth at rear end of pharynx; digestive branches radiating to periphery, not anastomosed.

Reproductive system.—Pearse's description and figure partly wrong. Vasa deferentia as in his fig. 22 confluent behind Lang's vesicle, then extending forward and turning back alongside the posterior part of the pharynx to enter male copulatory complex. Male antrum large, giving off laterally and anteriorly a semicircle of about seven pockets, each of which contains 1–3 large prostatic organs (prostatoids) (fig. 24, b). Each prostatoid is a pyriform body with a thick muscular wall through which pass the outlets of prostatic glands, discharging by way of the pointed free end of the prostatoid. Posterior pockets and prostatoids largest, size decreasing to anterior one. Penis papilla as in *Discocelis* (see Lang, 1884, pl. 30, fig. 1), short, truncate, depending from roof of male antrum; vasa deferentia enter it from in front around the sides of the antrum and unite to a common duct which continues as the penis lumen. Wall of male antrum and of penis papilla with numerous small prostatoids (adenoids), having a thinner muscular coat than the prostatoids and striated interior. Typical prostatic vesicle and seminal vesicle absent. Common genital pore. Female tract as in *Discocelis* (Lang, 1884, pl. 30, fig. 1). Vagina opens into posterior wall of common genital atrium, expands into cement pouch receiving numerous cement glands, proceeds dorsally, then curves posteriorly and downwards and after receiving uteri opens into crescentic Lang's vesicle (called by Pearse "pair of transverse accessory uterine organs").

Distribution.—Florida northward to Massachusetts, rare in the northern part of the range.

Habits.—Active, changeable, among shells and algae in shallow water; also pelagic, swimming at the surface.

Neotype.—Pearse's type of "*Discocelis grisea*," U. S. N. M. No. 20186, selected as the neotype of *Discocelis mutabilis* Verrill, now *Coronadena mutabilis*; two sets of serial sections also deposited in U. S. National Museum.

Remarks.—As study of Pearse's specimens labeled *Discocelis grisea* showed that the species is not a *Discocelis* but requires a new genus of the Discocelidae, I have proposed the name *Coronadena*.² Pearse claims his new species *grisea* differs from *mutabilis* in color and eye arrangement. As regards color, it was stated by him that the species is gray with radiating light streaks (Florida specimens). In Pearse and Littler (1938), some are said to be of this coloration, but others (presumably North Carolina specimens) are described as gray around the margin and somewhat speckled tan in the middle. In Pearse and Walker (1939), the specimen from Cape Lookout, N. C., which was called *Discocelis grisea* by Pearse and Littler, is now said to be *Discocelis mutabilis*. My examination of specimens from Florida and North Carolina (including the Cape Lookout specimen, labeled *Discocelis grisea*) has failed to show the slightest difference between them. I have also been unable to find any difference in eye arrangement between Pearse's specimens and Verrill's figures and descriptions of *D. mutabilis*. Unfortunately it has not been possible to find Verrill's type specimen. The young specimens of "*Discocelis grisea*" in the Pearse collection are also very much like the young *D. mutabilis* taken in the tow off Newport, R. I., and Woods Hole, Mass., by Verrill in 1882. I am therefore of the opinion that *grisea* and *mutabilis* are conspecific and that the correct name of the animal is *Coronadena mutabilis* (Verrill).

Family PLEHNIIDAE Bock, 1913

Definition.—Craspedommata of oval or elliptical form and thick firm consistency; marginal band of eyes limited to anterior half; cerebral and tentacular clusters present, also usually some frontal eyes; all eyes notably small (eyes altogether lacking in *Plehnia arctica*); pharynx small, central; tentacles absent; accessory seminal vesicles present⁴; prostatic vesicle free⁵; penis unarmed; Lang's vesicle present.

² Fuller description and illustrations of this genus and species were included in a paper I prepared for a Festschrift for Vejdovsky to be published in Prague. I read proof on this paper late in 1939, but have since heard nothing of it. Owing to conditions in Europe it is possible that it will never appear.

⁴ Accessory seminal vesicles are expanded terminal parts of the vasa deferentia with definite muscular walls.

⁵ The prostate is said to be free when it is not part of the male canal but opens into this by a duct.

Genus DISCOCELIDES Bergendal, 1893

Definition.—Plehniiidae with large prostatic vesicle in which the glandular portion exceeds the muscular portion; vasa deferentia entering separately the neck of the prostatic vesicle; Lang's vesicle large, elongate.

DISCOCELIDES ELLIPSOIDES (Girard, 1854) new combination

FIGURES 24, c; 25, a

Leptoplana ellipsoides GIRARD, 1854, p. 27, pl. 2, fig. 16 (not *L. ellipsoides* VERRILL, 1893).

Leptoplana folium VERRILL, 1873, pp. 487, 632.

Trigonoporus folium VERRILL, 1893, p. 487, pl. 41, fig. 5, 6; pl. 42, fig. 5; pl. 44, figs. 4-7.

Trigonoporus dendriticus VERRILL, 1893, p. 491, pl. 41, fig. 4; pl. 42, fig. 4; pl. 43, fig. 5.

Material.—One whole mount, U. S. F. C. No. 15621, labeled *Trigonoporus folium*; one whole mount, U. S. F. C. No. 14337, labeled *Leptoplana ellipsoides*; two unidentified vials, each with one specimen, in collection of U. S. National Museum; serial sections of posterior half of first specimen; anterior half remounted on original slide.

Form.—Elliptical, anterior end pointed, posterior more rounded (fig. 24, c); thick, firm; tentacles absent; maximum length, 20-25 mm., breadth 10-15 mm.; margins thin, flexible, undulated.

Eyes.—Marginal band limited to about anterior third; tentacular eyes in rounded clusters; cerebral eyes in loose elongated groups, which follow anteriorly the course of a pair of large nerve trunks (fig. 24, c); scattered frontal eyes may occur between cerebral groups and marginal band.

Color.—Flesh, yellowish, or yellowish brown with dendritic brown markings; reddish or pink tint on brain and main nerve trunks; white areas over pharynx and copulatory apparatus.

Digestive tract.—Pharynx central, small, short, with about five lobes on each side; mouth at about center of pharynx; intestine extremely dendritic, the branches anastomosed into a network with roundish meshes.

Reproductive system.—Male copulatory apparatus large, conspicuous, immediately behind the pharynx. Vasa deferentia forming "accessory seminal vesicles," i. e., expanded tubes with a thin muscular wall (fig. 24, c). These coil along the prostatic vesicle, entering the neck of this separately, one on each side. Prostatic vesicle large, bulbous, free, its anterior part with a thick wall of circular muscle fibers, which thins toward the neck of the prostate; the greater part of the prostate composed of scalloped glandular interior,

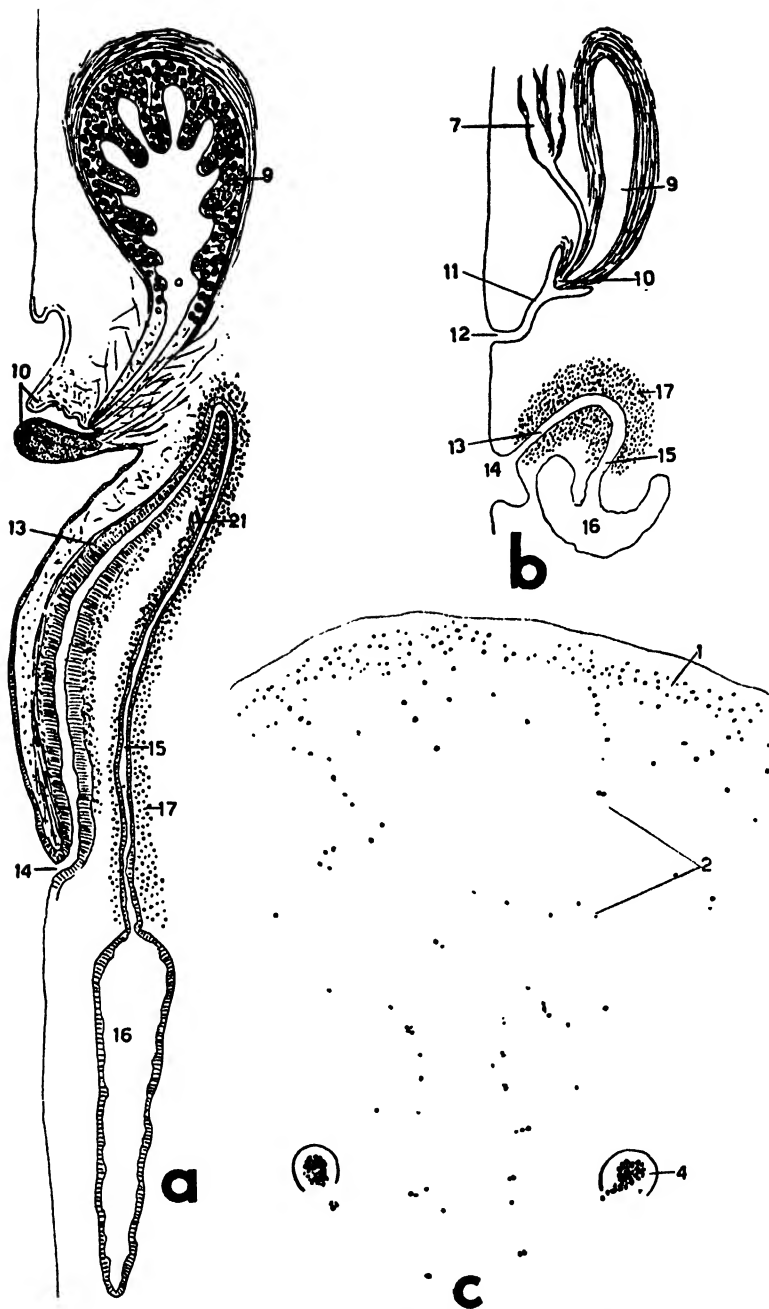


FIGURE 25.—a, Copulatory complex of *Discocelides ellipsoides* (Girard), from sections of posterior part of specimen shown in fig. 24, c; b, copulatory complex of *Latocestus whartoni* (Pearse), from sections of one of Pearse's specimens; c, eye arrangement of specimen of *Stylocheilus ellipticus* (Girard) from Seabrook, Tex., Pearse's specimen No. 385 (this specimen has numerous cerebrofrontal eyes). (See p. 492 for index to numbered parts.)

eosinophilous (fig. 25, *a*). After receiving vasa deferentia, narrowed distal end of prostate discharges into penis lumen. Penis papilla short, stout, posterior side very different from anterior. Posterior wall contains masses of structureless, apparently cuticular material, appearing black in whole specimen, and also much glandular material as coarse eosinophilous granules. Penis papilla appears to be protruded in specimen (fig. 25, *a*) so that there is no definite male antrum or male pore. Female pore some distance posterior to penis (figs. 24, *c*; 25, *a*), opens into long vagina with high epithelium and circular and longitudinal muscle layers; this proceeds forward to point above penis papilla, then makes a sharp backward bend and parallels its former course as a narrower tube, the stalk of Lang's vesicle. This stalk after proceeding posteriorly beyond the female genital pore opens into the large, elongate Lang's vesicle. The uteri enter the vagina shortly behind the bend (fig. 25, *a*). Numerous shell glands accompany the vagina near the entrance of the uteri and occur along the stalk of Lang's vesicle.

Distribution.—Long Island Sound northward, uncommon, found in shallow and deeper waters, to 1,100 feet, among rocks and shells. Found by Stimpson in the Bay of Fundy at 24 and 180 feet; found by Verrill at several points from Rhode Island to Maine in 24 to 270 feet. The four specimens available to me have the following labels: Slide No. 15621, Massachusetts Bay, *Speedwell*, July 26, 1878; slide No. 14337, Bay of Fundy, 1872; vial, Station 2486, *Albatross*, off Nova Scotia, lat. 44° N., long. 57° W., July 5, 1885, 1,140 feet; vial, Station 292, *Speedwell*, mouth of Cape Cod Bay, Race Point Light, August 11, 1879, 174 feet.

Habits.—Active, restless, can swim by active undulations, according to Stimpson; Verrill makes no statements about the animal's swimming.

Neotype.—Slide No. 15621 is made a neotype; anterior half as whole mount on original slide; posterior half as serial sections.

Remarks.—Slide No. 15621 is labeled *Trigonoporus folium*, and this identification was made by Verrill himself. Comparison of this specimen with Verrill's description of *T. folium* leaves no doubt of the identity. There is little doubt in my mind that *T. folium* and *T. dendriticus* are conspecific. Verrill's description and figures show no definite differences, and one of the specimens in a vial mentioned above came from almost the identical locality where Verrill collected his specimens of "*T. dendriticus*." It remains therefore to consider whether *Leptoplana ellipsoides* Girard and *Trigonoporus folium* Verrill are conspecific. As already noted, slide No. 14337 from the Bay of Fundy, hence the locality from which the original specimen of *L.*

ellipsoides came, is labeled *L. ellipsoides*, also identified by Verrill. This specimen is identical with the one labeled *T. folium* but is immature. The only other species from the Bay of Fundy that might be *Leptoplana ellipsoides* is *Notoplana atomata*. Bock, indeed, is of the opinion (1913) that *Leptoplana ellipsoides* is a synonym of *Notoplana atomata*, but he bases this decision on Verrill's figures (1892-93) labeled *Leptoplana ellipsoides*. Now I agree with Bock that these figures of Verrill's are really *Notoplana atomata*, but I think that Verrill's identification is erroneous. *N. atomata* and *L. ellipsoides* cannot possibly be identical, to my mind. First, the most definite character of *L. ellipsoides* in the original description is that the animal is elliptical, with pointed anterior end, whereas *N. atomata* is obovate with broad rounded anterior end. Second, it is stated by Girard that *L. ellipsoides* swims; *N. atomata* never swims. I am therefore confident that *L. ellipsoides* is not a synonym of *N. atomata* but that it is identical with *Trigonoporus folium*. The investigation of the best of the four specimens mentioned above, namely, the whole mount No. 15621, labeled *Trigonoporus folium*, has shown that the animal is not a *Trigonoporus* at all but fits best into the genus *Discocelides*. It differs from the only other known species of the genus, *D. langi*, described by Bock (1913) in that there is no connection between the vagina and the stalk of Lang's vesicle. Bock made the presence of this short duct a generic character, but it seems best to me to omit it from the generic definition in order to include *ellipsoides* in the genus. The present species is certainly closer to *D. langi* than it is to *Plehnia*, the only other genus of the Plehniidae. In *Plehnia* the prostate has a very thick muscular wall occupying the greater part of the organ and a small glandular interior, and Lang's vesicle is short and rounded.

Family LATOCESTIDAE Laidlaw, 1903

Definition.—Craspedommata with slender elongate bodies; tentacles absent; brain and anterior end strewn with numerous small eyes, not grouped into clusters; prostate vesicle free; seminal vesicle absent; penis unarmed.

Genus LATOCESTUS Plehn, 1896

Oculoplana PEARSE, 1938.

Definition.—Latocestidae with pharynx near the posterior end, hence with a very long main gut from pharynx to anterior end; copulatory apparatus behind pharynx very close to posterior end; genital pores separate; Lang's vesicle present.

LATOCESTUS WHARTONI (Pearse, 1938), new combinationFIGURE 25. *b*

Oculoplana whartoni PEARSE, 1938, p. 83, fig. 30.

Material.—Twenty-three whole mounts labeled by Pearse *Oculoplana whartoni*, including the type specimen; one of whole mounts made into sagittal serial sections.

Form.—Long and slender, about 8 times as long as wide in life; maximum length in life 36 mm., width 3 mm.; ends rounded; thin, mobile, sides parallel (for figure see Pearse, 1938, fig. 30). Sucker mentioned by Pearse and shown in his figure does not exist; that which Pearse so labels is merely an accidental fold of the margin.

Eyes.—Marginal band along entire margin, two or three rows wide anteriorly, thinning to a single irregular row posteriorly. Numerous small eyes strewn over anterior end, beginning medially behind the brain, extending anteriorly along the main nerve trunks (exaggerated in Pearse's drawing), then spreading fanlike over the anterior end to merge with the marginal eyes.

Color.—Uniform yellowish white.

Digestive tract.—Oval ruffled pharynx near posterior end; long main gut extends forward from this to behind brain giving off on each side numerous side branches; main gut forks behind brain and the forks run forward alongside main nerve trunks giving off branches obliquely forward (Pearse's figure of anterior gut branches erroneous).

Reproductive system.—Vasa deferentia and uteri seen along main gut in posterior third of body. Vasa deferentia have slightly muscular walls as they approach penis, hence do not form well-developed accessory seminal vesicles as in some other *Latocestus* species. Sections of copulatory apparatus poor because of bad histological state of available specimens. Male copulatory apparatus immediately behind pharynx. Prostatic vesicle free, of elongate oval form with thick muscular wall; it leads directly to conical penis papilla at inner end of short, narrow male canal leading to male genital pore (fig. 25, *b*). Vasa deferentia unite to common vas deferens, which joins duct of prostatic vesicle in the penis papilla. Female pore shortly behind male pore, larger than this; vagina runs dorsally, then curves posteriorly, and enters sausage-shaped transverse Lang's vesicle (fig. 25, *b*). Vagina accompanied by numerous cement glands, not muscular. Lang's vesicle variable in different specimens: narrow and transversely elongated in some, shorter and stouter in others; often with folded or irregular wall. Entrance of uteri could not be found.

Distribution.—Florida, North Carolina.

Habits.—On shells in shallow water.

Remarks.—Pearse failed to understand this species, placing it in the wrong section and family of the Polycladida; his genus *Oculoplana* becomes a synonym of *Latocestus*. The species is a typical *Latocestus*, agreeing with other members of the genus in the details of its anatomy. It is the first *Latocestus* to be found on the shores of North America.

Family STYLOCHIDAE Stimpson, 1857 (emend. Bock)

Definition.—Craspedommata with more or less elongate oval to oblong bodies of thick opaque texture; with a pair of tentacles containing eyes; cerebral and often frontal eyes also present; pharynx richly ruffled; copulatory complex in posterior body fourth; prostatic vesicle free; with true or accessory seminal vesicles.

Genus STYLOCHUS Ehrenberg, 1831

Imogine GIRARD, 1853.

Eustylochus VERRILL, 1892.

Definition.—Stylochidae with well-developed retractile tentacles; genital pores close together; true seminal vesicle, often tripartite; prostatic vesicle large; vagina simple, short; no Lang's vesicle.

STYLOCHUS ELLIPTICUS (Girard, 1850)

FIGURE 25, c

Planocera elliptica GIRARD, 1850, p. 251.

Planocera nebulosa GIRARD, 1853, p. 367.

Stylochopsis littoralis VERRILL, 1873, p. 632, pl. 19, fig. 99.

Stylochus littoralis LANG, 1884, p. 453.—MEIXNER, 1907, p. 428, pl. 27, fig. 8.

Eustylochus ellipticus VERRILL, 1892, p. 467, pl. 40, fig. 2; pl. 41, figs. 1, 1a; pl. 42, figs. 1, 1a.—PEARSE, 1938, p. 73.

Eustylochus meridionalis PEARSE, 1938, p. 73, fig. 25.

Stylochus ellipticus HYMAN, 1939a, p. 130, figs. 2, 3.

Material.—Many slides of Pearse labeled *Eustylochus meridionalis*, some labeled *Eustylochus ellipticus*, several unidentified vials in U. S. National Museum collection.

Form.—Oval, more or less elongate, flat, thick, with thinner margins, maximum length 20–25 mm., with a pair of tentacles at the level of the brain, elongate and pointed in life, often retracted to a rounded shape in preserved specimens. For general appearance see Hyman, 1939a, fig. 2, p. 133, and Pearse, 1938, fig. 25.

Eyes.—Marginal band of eyes limited to anterior third or half of the body; in some specimens scattered eyes smaller than those along the anterior margin may occur along rest of body margin. Tentacles filled with eyes; cerebral and frontal eyes not distinctly separable,

very variable. Typical arrangement, shown in my figure referred to above, is pair of groups of two to several eyes each between the tentacles, and another pair of two to several eyes each anterior to these; may also be a few eyes behind these four groups, over the brain ganglia. Some specimens in the Pearse collection, collected in Florida and at Seabrook, Tex., have a large number of cerebro-frontal eyes, beginning behind the tentacles, extending forward between the tentacles and then spreading fanlike toward the anterior margin, where they merge with the marginal band (fig. 25, *c*).

Color.—Very variable, cream, yellow, reddish brown, brown, olive, or gray, veined or reticulated with a lighter color, or finely maculated with a darker color on a lighter ground; with a middorsal light stripe, usually more noticeable toward the posterior end.

Digestive tract.—Pharynx about central, relatively small, moderately ruffled; digestive branches anastomosed into a reticulum in the periphery of the body (hence incorrectly shown by Pearse).

Reproductive system.—Described and figured by Hyman, 1939a, fig. 3, p. 133. Typical of the genus but differs from other species in that the copulatory complex is very close to the posterior margin.

Distribution.—Texas to Prince Edward Island, very common south of Massachusetts.

Habits.—Littoral, among barnacles, oysters, and shells, on pilings, under rocks; feeds on oysters and barnacles.

Remarks.—Pearse's attempt to revive the genus *Eustylochus* cannot stand, since this genus was based on "*Planocera*" *elliptica*, and I have shown that this species is a typical *Stylochus* (Hyman, 1939a). In that paper I overlooked the fact that Meixner, in 1907, investigated the same species and found it to be a *Stylochus*. There cannot be any doubt that the present species is Girard's *Planocera elliptica*, since his figures of this (1893) could not pertain to any other polyclad. In 1853, Girard, collecting off the Carolina coast, named gray specimens "*Planocera*" *nebulosa*, but obviously these are merely a color variation of *Stylochus ellipticus*. Pearse (1938) repeated the attempt to separate southern specimens as a new species, "*Eustylochus*" *meridionalis*, on the basis of color and arrangement of the cerebro-frontal eyes. If this were a valid species, its name would obviously be *nebulosa* Girard; but the points cited by Pearse are already covered in Verrill's account of the variations of *S. ellipticus*. My examination of Pearse's specimens labeled *Eustylochus meridionalis*, including serial sections made from some of them, has failed to show any grounds whatever for separating them from *S. ellipticus*. I have also sectioned the copulatory apparatus of one of the Seabrook, Tex., specimens mentioned above as having a large number of cerebrofrontal eyes, as in fig. 25, *c*, and found it to be identical with that of speci-

mens having a typical eye arrangement. I therefore refer all Pearse's specimens to *S. ellipticus*. A whole mount, U. S. F. C. No. 14398, collected under a wharf at Woods Hole, Mass., September 19, 1882, and labeled by Verrill *Planocera nebulosa* is *Stylochus ellipticus*.

STYLOCHUS FRONTALIS Verrill, 1892

Stylochus frontalis VERRILL, 1892, p. 465, pl. 44, fig. 1.

Stylochus inimicus PALOMBI, 1931, p. 218, figs. 1-4; pl. 4, figs. 1-4—PEARSE, 1938, p. 69, fig. 23.—PEARSE and WHARTON, 1938, figs. 1-21.

Stylochus tenax PALOMBI, 1936, p. 4, figs. 1-7; pl. 1, figs. 1, 2.

Material.—Many whole mounts collected by Pearse.

Form.—Oval, flat, of firm consistency, up to 50 mm. long by 27 mm. wide; tentacles conical, slightly tapering, very retractile (Pearse, 1938, fig. 23).

Eyes.—Numerous eyes in, some around, tentacles; cerebrofrontal eyes begin behind tentacles as paired elongate groups coming to a point posteriorly; anterior to tentacles these merge and spread in fan shape to join marginal band. Marginal band completely encircles margin, but is wider and of larger eyes anteriorly, diminishing posteriorly.

Color.—Gray or yellowish gray, lighter toward margins; Verrill reports some mottling with brown in a single specimen he had; Pearse and Wharton indicate a median light line.

Digestive tract.—Pharynx central, large, elongate, richly ruffled, with about five or six main branches on each side; mouth central; intestine richly branched, not anastomosed.

Reproductive system.—Figured and described by Palombi, 1931, 1936.

Distribution.—Florida to Texas, oyster beds; probably also northward to the Carolinas.

Habits.—Found among living and dead oyster shells; feeds chiefly on oysters; biology described by Pearse and Wharton, 1938.

Remarks.—Verrill found a single specimen, 25 by 12 mm., on the bottom of a ship that had come from the Carolina coast (see further under *Stylochoplana angusta*). There are only two stylochids common in that region—*S. ellipticus* and *S. inimicus*. Verrill's figure of the eyes clearly indicates *S. inimicus*, and his description also agrees satisfactorily with this species. I am therefore of the opinion that *S. inimicus* and *S. frontalis* are identical. Palombi assigned Florida stylochids preying on oysters to two species, *S. inimicus* and *S. tenax*. Pearse is of the opinion that these are conspecific. The U. S. National Museum has lent Palombi's paratypes of *S. tenax* for examination, and I have sectioned the copulatory apparatus of one of them. The paratypes are certainly very much thicker than any specimens of *S.*

inimicus available to me, but I cannot consider this character of any importance in view of the varying degrees of contraction produced in specimens of Turbellaria on fixation. I found no differences in eye arrangement and copulatory apparatus between the two forms. According to Palombi's figures and text, the genital pores are farther apart in *inimicus* than in *tenax*, but many of the whole mounts of *inimicus* kindly presented to me by Dr. Pearse show them as close together as in *tenax*. For *tenax* Palombi figures and describes numerous closely packed cement glands entering the middle third of the vagina and neither mentions nor illustrates any cement glands for *inimicus*; but my sections of *inimicus* have cement glands identical in location and arrangement with those of *tenax*. In short, I am of the same opinion as Pearse, that *inimicus* and *tenax* are identical.

STYLOCHUS ZEBRA (Verrill, 1882)

Stylochopsis zebra VERRILL, 1882, p. 462.

Stylochus zebra VERRILL, 1892, p. 463, pl. 40, fig. 3; pl. 42, figs. 2, 2a.—PEARSE, 1938, p. 72.—PEARSE and LITTLE, 1938, pl. 20, fig. 3.—HYMAN, 1939a, p. 133, fig. 1.

Material.—Number of whole mounts collected by Pearse.

Form.—Oblong or oblong-elliptical, thick, firm, rounded at ends, maximum length 30–40 mm., breadth 10–12 mm.; tentacles short, rounded.

Eyes.—Marginal band completely encircles margin, almost as wide posteriorly as anteriorly but with fewer and less crowded eyes. Tentacles contain numerous eyes; cerebral eyes in paired elongated clusters which merge into frontal eyes scattered over anterior end and merging into marginal band.

Color.—Dorsal pattern of alternating flesh and brown cross bars of which the most anterior and posterior ones are V-shaped.

Digestive tract.—Pharynx large, central, with elongate branching folds; mouth anterior.

Reproductive system.—Described and figured by Hyman, 1939a, fig. 1, p. 133; prostatic vesicle rounded, erect, penis papilla well developed, conical; seminal vesicle tripartite.

Distribution.—Massachusetts to North Carolina.

Habits.—Sluggish, inactive, found on wharves and pilings and oftenest in shells, especially those containing hermit crabs.

STYLOCHUS PULCHER, new species

FIGURE 26

Material.—One living specimen sent by Dr. Pearse.

Form.—Elongate, oblong, anterior end somewhat truncate, posterior end pointed (fig. 26, a), 30 mm. long, 8 mm. wide when extended in motion; tentacles rounded.

Eyes.—Numerous eyes in each tentacle; cerebral clusters large, broad; scattered frontal eyes; marginal band of numerous small eyes on anterior end becomes indistinct; marginal band of few scattered eyes in posterior half.

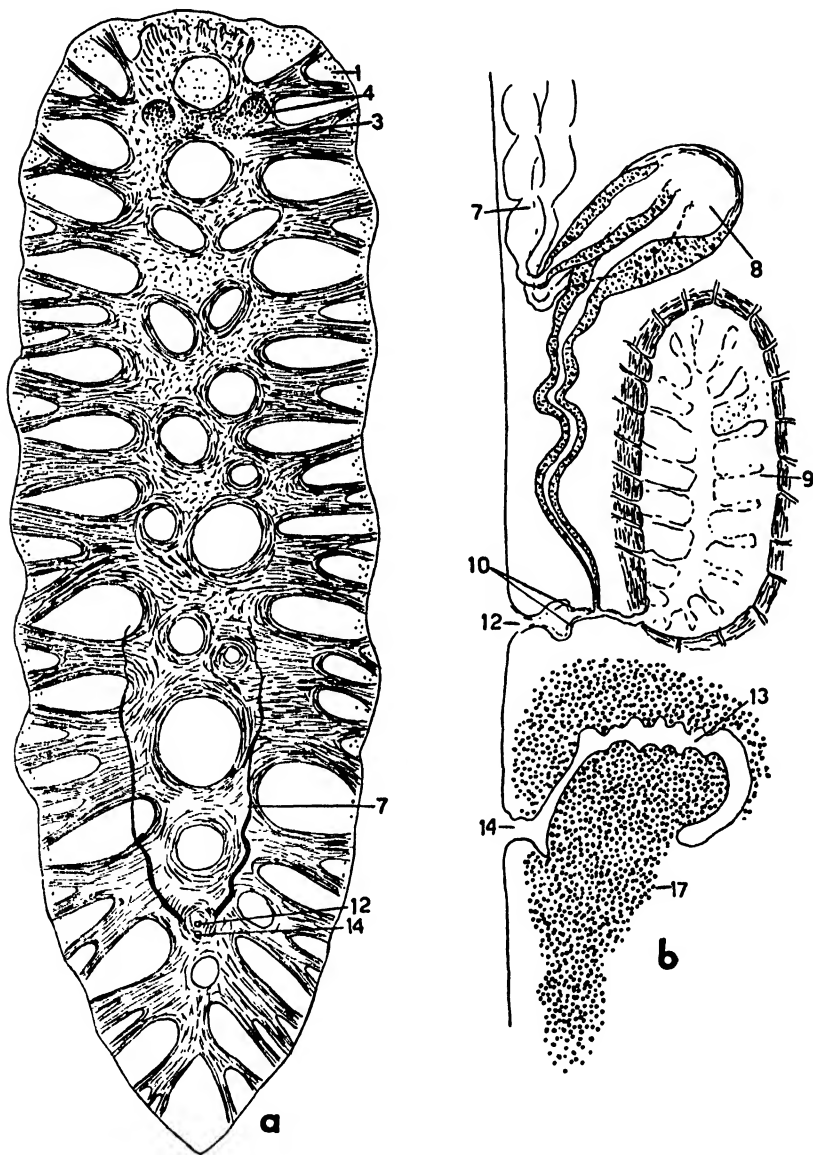


FIGURE 26.—*a*, *Stylochus pulcher*, new species, drawn from life; *b*, copulatory complex of *S. pulcher*, from sections made of sexual region of specimen shown in fig. 26, *a*. (See p. 492 for index to numbered parts.)

Color.—Dorsal surface with striking color pattern of brown on a flesh ground, similar to pattern of *S. zebra*; wide brown middorsal area interrupted by spots of ground flesh color; from this brown rays extend in groups to margin (fig. 26, *a*).

Digestive system.—Could not be seen because of pigment.

Reproductive system.—Sexual region removed and sectioned sagittally. Copulatory apparatus (fig. 26, *b*) typical of the genus *Stylochus*. Vasa deferentia seen in living animal proceeding backward from about middle of body. As they approach the copulatory apparatus they acquire a thick muscular wall and hence are accessory seminal vesicles. Copulatory apparatus in last fifth of body, about 6 mm. from posterior end. True seminal vesicle bulbous, somewhat erect; accessory seminal vesicles course along its anterior end before entering, producing tripartite seminal vesicle common in many species of *Stylochus*. From seminal vesicle muscular sinuous duct proceeds backward to enter duct of prostate vesicle. Prostatic vesicle large, oval, horizontal, with moderately thick muscular coat, and chambered interior; wall penetrated by ducts of extracapsular prostatic glands. Duct of prostatic vesicle runs directly ventrally, receives seminal vesicle; beyond this junction, canal becomes lumen of very slightly developed penis papilla; pyriform male atrium leads to male genital pore. Female genital pore shortly behind male one; vagina simple curved tube; proceeds dorsally, then curves backward to receive uteri; numerous cement glands along its course; vagina but slightly muscular.

Differential diagnosis.—*Stylochus pulcher* differs from other members of the genus in the color pattern, poor development of marginal band of eyes in the posterior half, and extremely small penis papilla.

Distribution.—Collected at Beaufort, N. C., dredged in 60 feet, in a snail shell occupied by a hermit crab.

Type.—Whole mount; copulatory apparatus as serial sections; U.S.N.M. No. 20531.

Remarks.—The possibility that this species might be merely a color variation of *S. zebra* was dispelled by study of the copulatory apparatus, which is obviously different from that of the latter.

STYLOCHUS OCULIFERUS (Girard, 1853)

FIGURES 27, 28, *c*

Imogine oculifera GIRARD, 1853, p. 387.

Stylochus oculiferus DIESING, 1861, p. 570.

Stylochus floridanus PEARSE, 1938, p. 71, fig. 24.

Material.—Five whole mounts in Pearse collection, including type of *Stylochus floridanus*; sexual region of three removed and sectioned.

Form.—Very large, oval with ruffled margins, maximum length 53 mm., width 27 mm. (fig. 27); tentacles conical, tapering to a point, but rounded and contracted in preserved specimens.

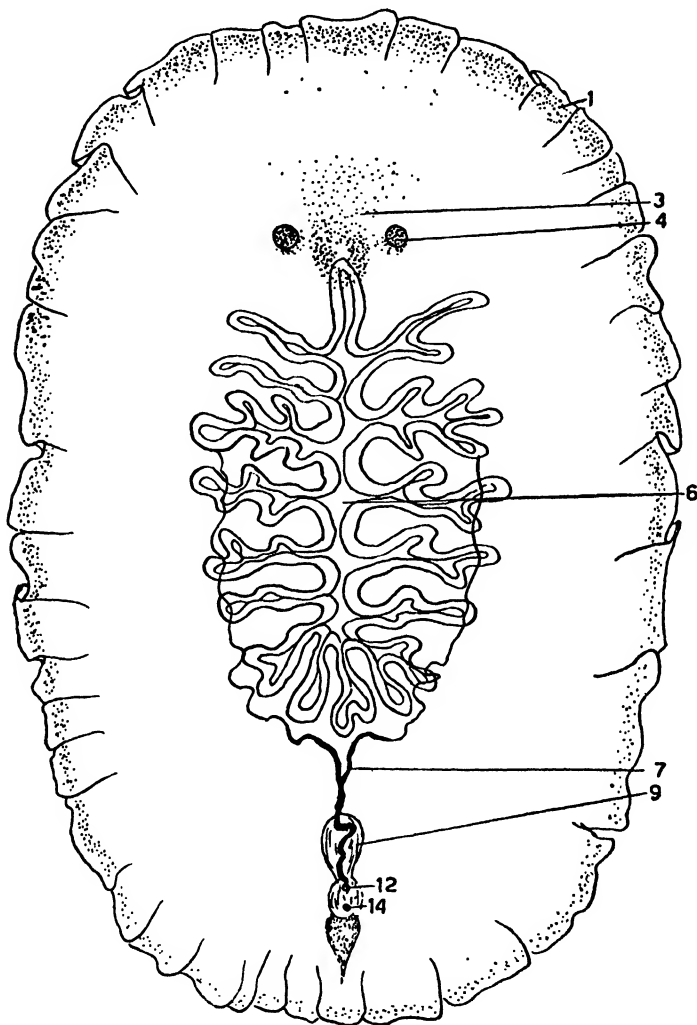


FIGURE 27.—*Stylochus oculiferus* (Girard): U. S. N. M. No. 20190. (See p. 492 for index to numbered parts.)

Eyes.—Marginal band well developed along the entire margin but broader and with more crowded eyes anteriorly; tentacles filled with eyes, eyes also around their bases; cerebral eyes begin behind level of tentacles as more or less paired, somewhat dense, elongated groups continuing laterally toward the tentacles as scattered eyes

and forward as diverging scattered eyes to a level about as far anterior to the tentacles as behind them; cerebral eyes therefore not merging into marginal eyes but separated from them by a considerable space practically free from eyes (fig. 27).

Color.—Cream to brown covered with small red or pink spots.

Digestive tract.—Pharynx central, large, with large complex lateral folds; mouth below anterior part of pharynx; intestine much branched to periphery, not anastomosed.

Reproductive system.—Sexual apparatus removed from the two largest specimens and sectioned but proved to be very immature despite presence of genital pores; it then became necessary to remove the sexual region of the "type" specimen for sectioning; this was mature but imperfect in the region of the penis papilla. Copulatory apparatus typical of the genus *Stylochus* (fig. 28, *a*). Ends of vasa deferentia with thick muscular walls forming accessory seminal vesicles; these open into true seminal vesicle, forming tripartite organ; muscular wall chiefly of circular muscles. Seminal vesicle tapers into sinuous duct, which joins duct of prostatic vesicle. Prostatic vesicle of moderate size, pyriform, with moderately thick wall of longitudinal fibers pierced by ducts of prostatic glands; interior chambered. Prostatic duct joins duct from seminal vesicle at base of penis papilla. Penis papilla imperfect in available sections but appears to be of elongate conical form (fig. 28, *a*). Female pore short distance behind male pore, leads into simple vagina only slightly muscular. Vagina extends vertically, then curves downward terminating by receiving the uteri. Numerous shell glands enter the middle third of the vagina.

Distribution.—Florida, North Carolina, rather rare.

Habits.—Found mostly on oyster beds.

Neotype.—Pearse's type specimen of "*Stylochus floridanus*," U.S.N.M. No. 20187, becomes the neotype of *Imogine oculifera* Girard; sexual region of this specimen as serial sections, three slides.

Remarks.—Comparison of the original description of *Imogine oculifera* with Pearse's description of "*Stylochus floridanus*" leaves no doubt of the identity of the two species. Pearse gave no grounds for placing the species in the genus *Stylochus*. As the genera of the Stylochidae cannot be determined without serial sections of the copulatory apparatus, it was necessary to have sections of a mature worm. After sections of the sexual region of two specimens showed them to be immature, it was unavoidable to remove and section the sexual part of the type specimen. These sections showed that the animal is a *Stylochus*, and hence Girard's genus *Imogine* becomes a synonym of *Stylochus*.

Section SCHEMATOMMATA Bock, 1913

Definition.—Acotylea without marginal eyes; eyes in cerebral and tentacular clusters, well back from the anterior margin.

Family LEPTOPLANIDAE Lang, 1884 (emend. Bock)

Definition.—Schematommata with flat, moderately elongate bodies, often expanded anteriorly; tentacles present or absent; prostatic vesicle when present always interpolated^a; usually brown above, seldom white; uteri confluent anterior to the pharynx.

Genus STYLOCHOPLANA Stimpson, 1857

Definition.—Leptoplanidae with distinct seminal vesicle and prostatic vesicle; the ejaculatory duct from the seminal vesicle does not penetrate into the prostatic vesicle.

STYLOCHOPLANA ANGUSTA (Verrill, 1893)

Leptoplana angusta VERRILL, 1893, p. 485, pl. 40, fig. 8; pl. 44, figs. 2, 3 (not *Stylochoplana angusta* Palombi, 1928, or *Leptoplana angusta* Pearse, 1938, or *Leptoplana angusta* Pearse and Littler, 1938).
Stylochoplana angusta HYMAN, 1939a, p. 139, figs. 10, 11.

Remarks.—I have already described this species, but one point was left unsettled—whether there are two exits to the genital atrium. Fortunately four more of the specimens collected by Verrill were found in U. S. National Museum material, and there is also a small specimen mounted whole in Pearse's Florida material. Two of the Verrill specimens and the Florida specimen were sectioned; the latter showed but one genital pore; of the Verrill specimens, one was in poor shape but the other clearly has two genital pores, one in the usual ventral position, the other opening posteriorly into the notch. It seems probable that only the ripper specimens have the second opening. This peculiarity together with the far anterior position of Lang's vesicle would justify the creation of a new genus for this species. I forbear to do so, since Palombi, who has made a special study of the genus *Stylochoplana*, informs me in a letter that he proposes to create such a genus. The extra genital pore of the species appears to represent a very short ductus vaginalis, a structure not uncommon in the family Leptoplanidae (see below, p. 475).

Pearse and associates confused three different species under the name *Leptoplana angusta* and Pearse and Walker list *angusta* among New England polyclads. It is not, however, a New England form, since Verrill found his specimens on the bottom of a whaling vessel

^aThe prostate is said to be interpolated when it forms part of the male canal so that the sperm passes through its lumen.

that had come from the Carolinas. Now that a specimen from Florida (Port St. Joe, collected March 11, 1936) has turned up in the Pearse material, it may be asserted with certainty that the species is a native of the southern part of our Atlantic coast. Previous to this finding I was inclined to believe that the vessel had acquired the worms elsewhere. The probability that the other polyclad found by Verrill on the same vessel, namely, *Stylochus frontalis*, is also native to the same region, induced me to examine Verrill's figure and description of this form more closely, and I then recognized it as the polyclad known as *Stylochus inimicus* (see p. 461).

Genus NOTOPLANA Laidlaw, 1903

Leptoplana (in part).

Definition.—Leptoplanidae with distinct seminal vesicle and chambered prostatic vesicle; the duct from the seminal vesicle projects into the interior of the prostatic vesicle; tentacles usually absent.

NOTOPLANA ATOMATA (O. F. Müller, 1776)

Planaria atomata O. F. MÜLLER, 1776, p. 223.

Leptoplana atomata ØRSTED, 1843, p. 569.

Leptoplana dröwbachensis ØRSTED, 1845, p. 415.

?*Polycelis variabilis* GIRARD, 1850, p. 251.

Leptoplana variabilis DIESING, 1861, p. 542.—VERRILL, 1892, p. 480, pl. 41, fig. 7; pl. 43, figs. 2, 3.

Leptoplana virilis VERRILL, 1892, p. 478.—PEARSE and WALKER, 1939, p. 17, fig. 8.

Leptoplana ellipsoides VERRILL, 1893, p. 483, pl. 40, figs. 5, 6; pl. 43, fig. 4 (not *L. ellipsoides* GIRARD, 1854).

Notoplana atomata BOCK, 1913, p. 195.—HYMAN, 1939a, p. 135, figs. 4, 5.

Leptoplana angusta PEARSE, 1938, p. 76, fig. 26 (not *L. angusta* VERRILL, 1893).

Material.—Many whole mounts in Pearse collection, some labeled *Notoplana atomata*, others *Leptoplana angusta*, and *Leptoplana virilis*; several unidentified vials in collection of U. S. National Museum; six whole mounts found in Peabody Museum, two labeled *Leptoplana variabilis* by Verrill.

Form.—Typically leptoplanid, elongated obovate or oblancoelate (see Hyman, 1939a, fig. 4, p. 137), broadest through the level of the brain, thence tapering to the rounded or obtuse posterior end; tentacles absent; maximum length 28 mm.

Eyes.—In four conspicuous, well-separated clusters, two tentacular and two cerebral; tentacular clusters rounded of 6–15 large eyes and a few smaller ones; cerebral clusters more elongated, of 15–60 eyes of various sizes, but smaller than the largest of the tentacular eyes. Number of eyes increases with age.

Color.—Various shades of brown, more or less flecked and streaky.

Digestive tract.—Pharynx central, elongated, well ruffled, mouth anterior to center of pharynx, intestinal branches radiating, anasto-

mosed to a network with rounded meshes, in which the ova are often conspicuous.

Reproductive system.—Fully described and illustrated by Bock, 1913, and Hyman, 1939a. Diagnostic features are the spherical prostate, elongated penis pocket containing the arched penis stylet, and the long, slender Lang's vesicle.

Distribution.—Massachusetts northward to Scandinavia, common.

Habits.—Sluggish, littoral, under stones and on seaweeds, in tide pools, on pilings, also sublittoral to 300 feet.

Remarks.—This is the commonest polyclad of the north Atlantic coast of North America. Although it seems to me easily recognized, it has been regularly misidentified. Mature individuals are easily identified by the curved penis stylet, seen by putting a little pressure on the animal. Verrill called this species by three different names, *Leptoplana variabilis*, *L. virilis*, and *L. ellipsoides*. Whether it actually is Girard's *Polycelis variabilis* is difficult to decide, because of the nature of the original description. Since Verrill's time, the species has been commonly called *Leptoplana variabilis* by American zoologists. Previously I had some little doubt that Verrill's figures of *Leptoplana variabilis* could be certainly identified as *N. atomata*, since they differ in some details; but these are probably inaccuracies, and the finding of two specimens labeled *L. variabilis* by Verrill himself confirms the identity. I am also decidedly of the opinion that Verrill's species *L. virilis* is likewise *N. atomata*. I have already expressed my opinion that what Verrill mistakenly called *L. ellipsoides* are specimens of *N. atomata*.

Pearse and associates frequently failed to recognize *N. atomata*. In the collections of the U. S. National Museum there exists a whole mount No. 134562 collected in Baffin Bay by Capt. Robert A. Bartlett, August 3, 1935, which had been identified by Pearse as *Leptoplana folium*. This specimen is figured in Pearse, 1938, fig. 26, where it is called *Leptoplana angusta*. In Pearse and Walker, the same whole mount is said to be *Leptoplana virilis*. I have examined this whole mount and find it to be *Notoplana atomata*. The following three whole mounts in the possession of the U. S. National Museum, which were identified by Pearse as *Leptoplana angusta*, are also *N. atomata*: U. S. F. C. No. 15620, Nantucket, Mass., September 8, 1875, 81 feet; U. S. F. C. No. 15622 (two slides), Bay of Fundy, off Cherry Island, 1872, 120–150 feet, originally labeled *Leptoplana ellipsoides*. *Notoplana atomata* is thus one of the three leptoplanid species confused by Pearse and his associates under the name of *Leptoplana angusta*.

In addition there were in the material sent by the U. S. National Museum a number of unidentified vials all of which are *Notoplana*

atomata. These came from various points off the coast of Massachusetts and from Casco Bay, Maine.

Genus EUPLANA Girard, 1893

Discoplana BOCK, 1913.

Conjuguterus PEARSE, 1938.

Definition.—Leptoplanidae without definite prostatic vesicle; tentacles absent; body usually elongated, more or less slender.

EUPLANA GRACILIS (Girard, 1850)

Prosthiosomum gracile GIRARD, 1850, p. 251.—VERRILL, 1893, p. 496, fig. 1.—PEARSE and WALKER, 1939, p. 19, fig. 15.

Euplana gracilis GIRARD, 1893, p. 198, pl. 6, fig. 62.—PEARSE and LITTLER, 1938, p. 238, pl. 20, fig. 6.—PEARSE and WALKER, 1939, p. 18, fig. 13.—HYMAN, 1939a, p. 137, figs. 6-8.

Conjuguterus parvus PEARSE, 1938, p. 81, fig. 29.

Material.—Many whole mounts labeled by Pearse *Conjuguterus parvus*, including type.

Form.—Small, slender, elongate, anterior end rounded to obtuse, maximum length, 8-10 mm., without tentacles (for figure see Hyman, 1939a, fig. 6, p. 137).

Eyes.—Remarkably few, usually six on each side; tentacular groups consist of two eyes each, cerebral groups of four eyes on each side in an irregular lengthwise row.

Color.—Yellowish or brownish gray, somewhat speckled.

Digestive tract.—Pharynx small, only slightly ruffled, anterior to middle; main intestinal trunk conspicuous behind pharynx; from this lateral branches extend to periphery, not anastomosed.

Reproductive system.—Described and figured by Hyman, 1939a, fig. 8, p. 137. Description of Pearse (1938, p. 81) erroneous; no prostatic vesicle, no penis papilla, no Lang's vesicle.

Distribution.—Florida to Prince Edward Island, common.

Habits.—Active, among seaweeds, hydroids, tunicates, etc., on pilings, also among old shells, littoral.

Remarks.—This species was wrongly placed by Pearse and considered a type of a new genus, *Conjuguterus*, which is a synonym of *Euplana*. In Pearse and Littler and Pearse and Walker the name was changed to *Euplana gracilis* (in consequence of information received from me in letters), but it was nowhere indicated that this was the same species previously called *Conjuguterus parvus* nor was the erroneous familial placing corrected. In Pearse and Walker *Euplana gracilis* and *Prosthiosomum gracile* are presented as distinct species and each is figured; the figure of the latter appears to have been constructed by slightly altering *Prosthiosomum lobatum*, a genuine species of *Prosthiosomum*. As I already pointed out

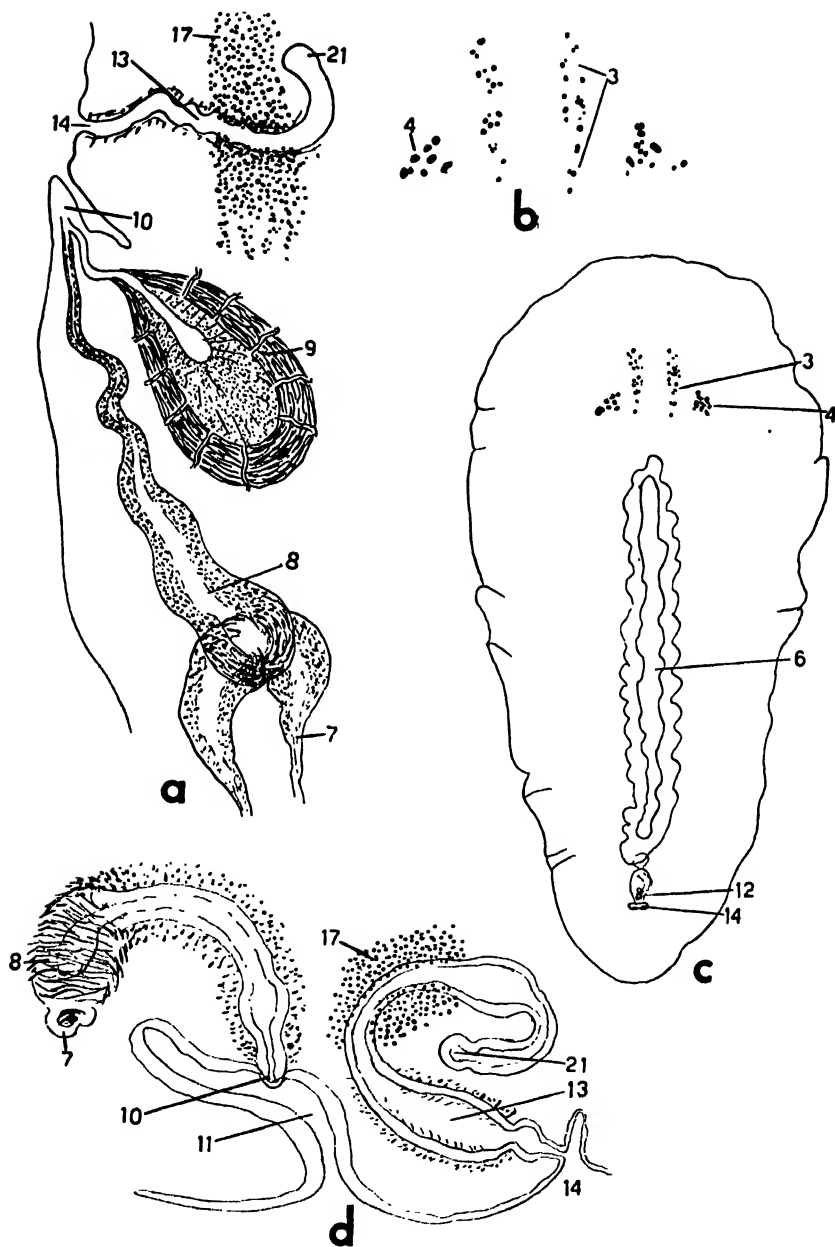


FIGURE 28.—*a*, Copulatory apparatus of *Stylochus oculiferus* (Girard), from sections of sexual region of specimen shown in fig. 27; *b*, eyes of *Euplana carolinensis*, new species; *c*, *E. carolinensis*, from Pearse's whole mount No. 370, type; *d*, copulatory complex of *E. carolinensis*, from sections made of rear part of specimen shown in fig. 28, *c*. (See p. 492 for index to numbered parts.)

(Hyman, 1939a), *P. gracile* is not a *Prosthiostomum* at all and this was realized by Girard himself in 1893 when he created a new genus for the species.

EUPLANA CAROLINENSIS, new species

FIGURE 28, b-d

Leptoplana angusta PEARSE and LITTLER, 1938, p. 237.

Material.—One whole mount in Pearse collection labeled *Leptoplana angusta*, slide No. 370.

Form.—Elongate obovate, anteriorly expanded, widest at level of brain, tapering from there to blunt posterior end, 5 mm. long (somewhat contracted); no tentacles (fig. 28, c).

Eyes.—In four separated clusters; tentacular clusters rounded, of 8–12 eyes; cerebral clusters elongated, of 20–25 eyes (fig. 28, b).

Color.—Unknown, presumably brownish above.

Digestive tract.—Pharynx long and narrow (fig. 28, e), with slight folds; digestive branches not well seen.

Reproductive system.—Copulatory apparatus directly behind the pharynx (fig. 28, c); genital pores separate, but only a short distance apart. Sections of copulatory apparatus poor, but apparatus corresponds to the genus *Euplana* without much doubt; probably distorted by flattening of specimen to make a whole mount. Male genital pore leads into elongated male atrium (fig. 28, d), probably distorted. Vasa deferentia enter from below bulbous seminal vesicle with thick wall of circular fibers. From this muscular male canal proceeds posteriorly and terminates in small penis papilla projecting into roof of male atrium. There appeared to be no definite differentiation of a prostatic vesicle, nor could any prostatic glands be seen, because of the poor histological state of the specimen. Female genital pore opens into a sort of pocket, probably artificial; vagina with thin muscular coat proceeds anteriorly, then dorsally, and finally makes a U-shaped curve, receiving the uteri at the end of this curve (fig. 28, d); Lang's vesicle absent. Cement glands enter that part of the vagina preceding the U-bend.

Differential diagnosis.—Combination of elongate pharynx, separated cerebral and tentacular eye clusters, long male atrium, small penis papilla, enlarged seminal vesicle, and curved vagina.

Distribution.—Beaufort, N. C., Bogue Sound, on shells, ascidians, collected by Pearse, September 9, 1937.

Type.—Anterior half as whole mount, posterior half as sagittal sections (1 slide), U. S. N. M. No. 20532.

Remarks.—This is the second leptoplanid confused by Pearse under the name *Leptoplana angusta*. It is the specimen mentioned

in Pearse and Littler (p. 237) under this name as collected in Bogue Sound. The specimen mentioned in Pearse (1938, p. 77) as collected at Beaufort in 1938 could not be found in the Pearse material.

DIGYNOPORA, new genus

Definition.—Leptoplanidae with a ductus vaginalis opening to the exterior by a separate pore behind the common genital pore; male system as in *Stylochoplana*; tentacles wanting.

Type.—*D. americana*, new species.

DIGYNOPORA AMERICANA, new species

FIGURE 29, a-c

Leptoplane angusta PEARSE and LITTLER, 1938, pl. 20, fig. 4.

Material.—One whole mount in Pearse collection, No. 446.

Form.—Elongate, slender, ends rounded, sides probably parallel, length 13.5 mm., width 5 mm., contracted, much longer and slenderer in life (26 mm. according to Pearse); tentacles wanting (fig. 29, *b*). (The description of Pearse and Littler of this specimen is merely a copy of Verrill's description of *Leptoplane angusta*.)

Eyes.—Tentacular and cerebral clusters blended on each side into an elongated group of about 40–50 eyes (fig. 29, *a*) in which the tentacular groups containing the larger eyes can be somewhat distinguished.

Color.—Statement of Pearse and Littler about the color is a copy of Verrill's statement but very likely the animal is brown above.

Digestive system.—Pharynx elongated, narrow, with moderate lateral folds, slightly anterior to center of body (fig. 29, *b*); digestive branches radiating, anastomosed.

Reproductive system.—Sexual region removed and sectioned; found in very bad histological condition, especially the female tract. Common genital pore well removed from posterior end, about 3 mm. from this (fig. 29, *b*). Male apparatus as in the genus *Stylochoplana*. Male antrum occupied by large penis papilla of elongated conical form, not very muscular (fig. 29, *c*). Vasa deferentia proceed along rear part of pharynx as sinuous tubes, enter ventral end of oval seminal vesicle with thick muscular wall of circular fibers. Narrowed duct also with muscular wall of circular fibers proceeds posteriorly, enters oval prostatic vesicle, larger than seminal vesicle, with very thick muscular wall of chiefly circular fibers, penetrated by ducts of gland cells; relatively small lumen of prostate lined by glandular epithelium. Prostate passes directly into penis papilla. Female tract unfortunately could not be clearly made out on the sections, but the presence of a ductus vaginalis is definite. Vagina opens by small

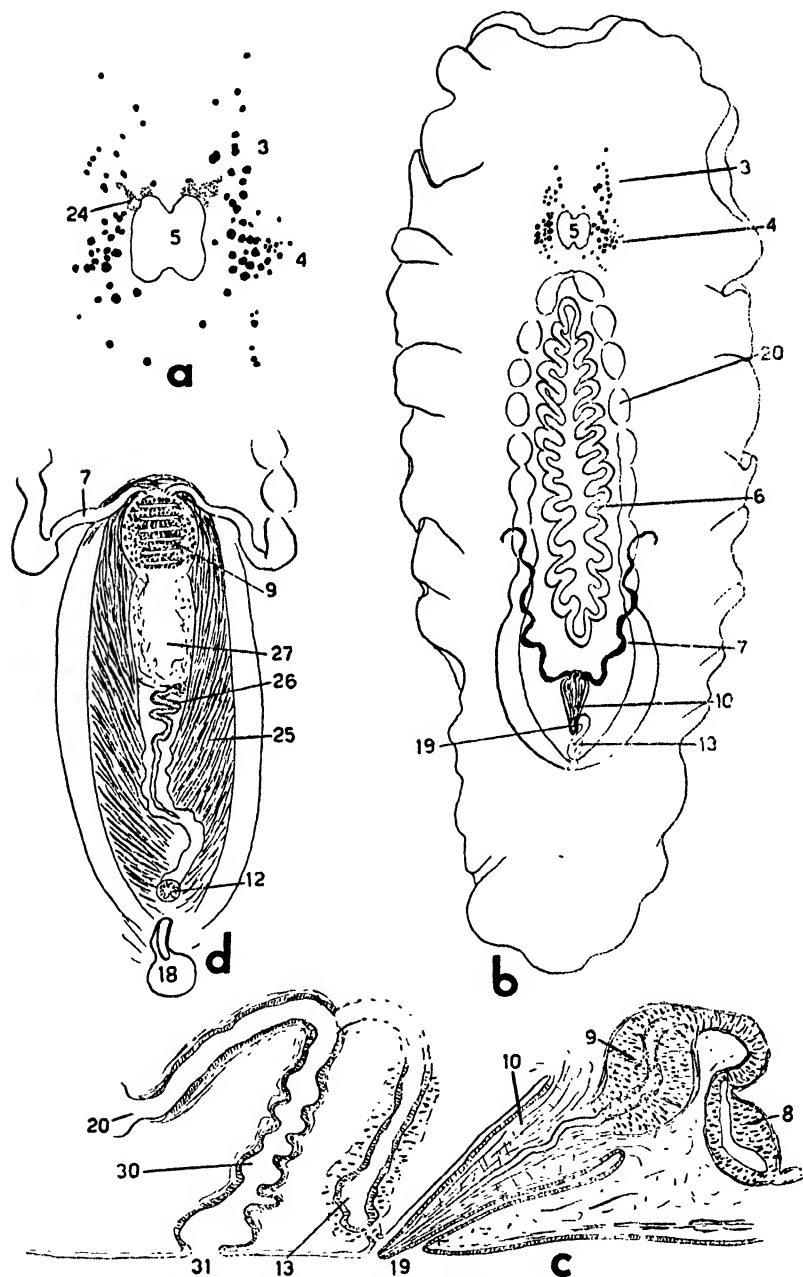


FIGURE 29.—*a*, Eyes of *Digynopora americana*, new genus and species, same specimen as fig. 29, *b*; *b*, *D. americana*, from Pearse's whole mount No. 446, type; *c*, copulatory organs of *D. americana*, from sections made of sexual region of specimen shown in fig. 29, *b*; *d*, Dorsal view of copulatory complex of *Planctoplanella atlantica*, new genus and species. (See p. 492 for index to numbered parts.)

aperture into rear wall of genital atrium but the actual connection, although I do not doubt its existence, could not be seen on the sections. Vagina then proceeds dorsally and appears to make a downward bend as a ductus vaginalis opening ventrally by a large pore behind the common genital pore (fig. 29, *c*); but as indicated in the figure the continuity could not be entirely traced. Vagina and ductus vaginalis with moderately muscular walls of inner circular and outer longitudinal fibers. From dorsal end of ductus vaginalis duct proceeds posteriorly and appears to receive the much-swollen uteri; hence this duct is seemingly the connection of the uteri with the vagina. Its continuity with the ductus vaginalis was perfectly clear on the sections; but as already noted the continuity of both with the vagina could not be established. The complete elucidation of this very interesting species must await the finding of further material.

Distribution.—St. Josephs Bay, Fla., five individuals taken by Pearse in March 1936 (whereabouts of the other four specimens could not be ascertained).

Habits.—Among ascidians on pilings.

Type.—One whole mount; sexual region as serial sections (2 slides), U. S. N. M. No. 20533.

Remarks.—This is the third species that Pearse called *Leptoplana angusta*. It is the specimen mentioned by Pearse (1938, p. 77) as collected at St. Josephs Bay, Fla., March 28, 1936. The drawing, fig. 4, pl. 20, in Pearse and Littler labeled *Leptoplana angusta* is also *Digynopora americana*. This drawing purports to represent a Beaufort polyclad, but actually the individual from which the drawing was made is the type specimen of *Digynopora americana*, from Florida. The species from around Beaufort which Pearse and Littler confused with the Florida form is *Euplana carolinensis*, described above.

The presence of a ductus vaginalis, i. e., a canal leading from the vagina to an accessory external opening or looping back to reenter the vagina near the regular genital pore, is not uncommon in acotylean polyclads. Bock (1925) has discussed its occurrence and has pointed out that this condition is particularly apt to develop in the families Leptoplanidae and Stylochidae. Genera with a ductus vaginalis lack Lang's vesicle. Three leptoplanid genera have already been based on the presence of a ductus vaginalis. These are *Tripylocelis* Haswell, 1907, in which the ductus opens externally by a pore behind the regular female pore and the male apparatus resembles *Euplana*; *Copidoplana* Bock, 1913, with a similar ductus vaginalis, and male apparatus as in *Notoplana*; and *Ceratoplana* Bock, 1925, in which the ductus makes a loop, reentering the vagina, and the male apparatus resembles that of *Stylochoplana*. I had

hoped to avoid making a new genus for the present species by placing it in an existing leptoplanid genus with a ductus, but it does not seem to fit well enough into any of the three mentioned, although it is fairly similar to *Ceratoplana*. It differs from this genus in that it lacks tentacles and the ductus vaginalis opens separately instead of looping back into the vagina. Altogether it has seemed best to create a new genus for the species.

Family HOPLOPLANIDAE Stummer-Traunfels, 1933

Definition.—Schematommata of oval form, usually with tentacles; penis consists of a stylet fastened directly to the prostatic vesicle; true seminal vesicle absent; instead there are strongly developed accessory seminal vesicles; no Lang's vesicle.

Genus HOPLOPLANA Laidlaw, 1902

Definition.—With the characters of the family.

HOPLOPLANA INQUILINA (Wheeler 1894)

Planocera inquitina WHEELER, 1894, p. 196, fig. 1.

Hoploplana inquitina BOCK, 1913, p. 228.—HYMAN, 1939a, p. 145, figs. 12, 13.

Material.—Two whole mounts and two sets of serial sections in Pearse collection.

Form.—Oval, flat, 6 mm. long by 4 mm. wide, with pointed conical tentacles (see figure in Wheeler, 1894, p. 197).

Eyes.—Cluster of tentacular eyes in and around tentacle bases of about 15 eyes each; loose cerebral clusters of 6–10 eyes extending forward from the brain.

Color.—Pale, translucent, with a reticulum of granules white by reflected, black by transmitted light.

Digestive tract.—Pharynx central, broadly oval, ruffled, with wide ruffled folds; intestinal branches radiating to periphery with small lateral branches, not anastomosed.

Reproductive system.—Described by Wheeler (1894), some points added by Hyman, 1939a (figs. 12, 13, p. 145). What Wheeler called the penis is the prostatic vesicle, to which the small pointed penis stylet is directly fastened; prostatic vesicle spherical with thick muscular wall and small glandular center. Vasa deferentia greatly expanded with thick muscular walls, serving as accessory seminal vesicles; common ejaculatory duct formed by their union penetrates prostate to base of penis stylet.

Distribution.—Recorded only from Woods Hole, Mass.

Habits.—Sluggish, creeping slowly, commensal in the mantle cavity of the snail *Busycon*.

HOPIOPLANA INQUILINA THAISANA Pearse, 1938, new combination

Hoploplana thaisana PEARSE, 1938, p. 79, fig. 28.

Material.—One whole mount, labeled *Hoploplana thaisana*, type, U. S. N. M. No. 20189.

Form.—Oval, flat, 1 to 3 mm. long, 0.7 to 2.1 mm. broad; with conical tentacles.

Eyes.—Eyes, 10–26 around and in each tentacle base; 2–11 eyes in each cerebral group. Pearse claims the tentacular group is rounded in *H. thaisana* and horseshoe-shaped in *H. inquilina*. Wheeler's figure fails to show any difference from Pearse's of *H. thaisana* (Pearse, 1938, fig. 28) in this regard. In the two whole mounts of *H. inquilina* available to me at the present writing, the tentacular eyes do show a somewhat semicircular grouping but whether this arrangement is constant can be determined only by examination of large numbers of both forms.

Color.—Not stated by Pearse.

Digestive tract.—As in *H. inquilina*; claim of Pearse that the bases of the pharynx folds are less lobulated in *thaisana* than in *inquilina* could not be substantiated by comparison of the available specimens.

Reproductive system.—Only briefly mentioned by Pearse; what he calls the seminal vesicle is the prostate. As there was but the one specimen of *thaisana* in the collection I have forborne to section it. Attempts to obtain additional material proved futile. As far as I can determine from examination of the stained type specimen, the copulatory complex is identical with that of *H. inquilina*.

Distribution.—St. Vincent Bar, Apalachicola Bay, Fla.

Habits.—Commensal in the snail *Thais floridana floridana*; also found with oysters and barnacles.

Remarks.—In so far as can be determined from the available data and material, *H. thaisana* differs from *H. inquilina* only in its smaller size and in its commensalism with a different snail host. I am therefore of the opinion that it is at best a geographical subspecies and hence should be named *H. inquilina thaisana*.

Family PLANOCERIDAE Lang, 1884 (emend. Bock, 1913)

Definition.—Schematommata with a cirrus; cirrus sac lined by spines, hooks, or ridges eversible to the exterior, or a long cuticularized papilla may be present; often with tentacles; true or accessory seminal vesicles; prostate free or interpolated; vagina often highly muscular; uteri not confluent anterior to the pharynx.

Genus GNESIOCEROS Diesing, 1861

Pelagoplana BOCK, 1913.

Definition.—Planoceridae with oblongate pellucid bodies; with tentacles containing eyes; with true seminal vesicle and interpolated prostatic vesicle; cirrus armed with parallel toothed bands; vagina with a powerful musculo-glandular fold; Lang's vesicle transverse.

GNESIOCEROS FLORIDANA (Pearse, 1938), new combination

Imogene oculifera VERRILL, 1892, p. 475, pl. 40, fig. 1 (not *I. oculifera* Girard, 1853).

Stylochoplana floridana PEARSE, 1938, p. 77, fig. 27.—PEARSE and LITTLER, 1938, pl. 20, fig. 5; pl. 22, figs. 14, 15, 17.

Stylochoplana oculifera PEARSE and WALKER, 1939, p. 18, fig. 10.

Gnesioceros verrilli HYMAN, 1939a, p. 146, figs. 14–16.

Material.—Many whole mounts and one set of serial sections in Pearse collection, labeled *Stylochoplana floridana*, including type.

Form.—Oblongate, anteriorly expanded, tapering to a pointed posterior end (see Hyman, 1939a, fig. 14, p. 145; also Pearse and Littler, 1938, pl. 20, fig. 5); small, 6–8 mm. long; with a pair of elongate, pointed tentacles.

Eyes.—Each tentacle contains 4–10 eyes; loose cerebral groups of 8–20 eyes each lie between the tentacles extending before and behind their level.

Color.—Translucent greenish.

Digestive tract.—Pharynx elongate, central, with moderate ruffles; intestinal branches greatly anastomosed, forming a reticulum with rounded meshes.

Reproductive system.—Fully described and figured in Hyman, 1939a, figs. 15, 16. Pearse's figure and description (1938, p. 77, fig. 27) contain errors; the uteri are not confluent anterior to the pharynx; Lang's vesicle is transversely crescentic, not globular. It is correctly shown in Pearse and Littler, fig. 14, pl. 22, where, however, it is labeled seminal receptacle, and the prostate is labeled efferent duct. The cirrus is figured by Pearse and Littler, fig. 15, pl. 22, but I am unable to understand the long strands shown coursing through the cirrus. I have never in many specimens studied seen any such structures. In Pearse and Littler's fig. 17, pl. 22, the prostate is called penis and the seminal vesicle is called prostate. Their sagittal section, fig. 21, pl. 23, is in error in that a common genital pore is indicated; the species has separate genital pores.

The genus *Gnesioceros* has a cirrus composed of parallel toothed bands eversible to the exterior. There is an elongated cylindrical prostate made of a succession of transverse chambers and enclosed in the same muscular sheath as the cirrus. The thick musculoglan-

dular vaginal fold characteristic of the genus is present in only the anterior vaginal wall in *G. floridana*.

Distribution.—Florida to Massachusetts, common in the southern part of the range.

Habits.—Among seaweeds, quick, active, may swim to some extent.

Remarks.—Pearse placed this species in the wrong family and genus. In Pearse and in Pearse and Littler the species is called *Stylochoplanea floridana*, and in Pearse and Walker the name *Stylochoplanea oculifera* is used, apparently for the same species. As I pointed out (Hyman, 1939a), Verrill saw a specimen of this species at Quisset Harbor near Woods Hole and mistakenly identified it as *Imogene oculifera* Girard. I therefore gave the animal a new name, *Gnesioceros verrilli*, but as Pearse's publication antedates mine, it is necessary to alter the name to *Gnesioceros floridana*.

PLANCTOPLANELLA, new genus

Definition.—Planoceridae without true seminal vesicle; interpolated prostate with transverse chambers as in *Gnesioceros*; cirrus sac with thick muscular wall and vermiform cirrus papilla as in *Planctoplanea*; Lang's vesicle absent.

Type.—*P. atlantica*, new species.

PLANCTOPLANELLA ATLANTICA, new species

FIGURES 29, *d*; 30

Material.—Four specimens in vial sent by U. S. National Museum, serial sections made of sexual region of one of them.

Form.—Egg-shaped (fig. 30, *a*), posterior end broadest, to 8.5 mm. long by 4 mm. wide (preserved); no evident tentacles, but their absence is not certain, as no suitable sections are available to determine this point.

Eyes.—Small, all of the same size, tentacular clusters not very distinct from cerebral groups; eyes loosely arranged, extending behind and in front of the brain (fig. 29, *d*).

Color.—Preserved specimens white, probably translucent in life.

Digestive tract.—Pharynx small, central, with a few folds (fig. 30, *a*); intestine dendritic, anastomosed.

Reproductive system.—Enlarged vasa deferentia along posterior half of pharynx (fig. 30, *a*) have thin muscular coats, hence form moderately developed accessory seminal vesicles. They enter separately the anterior end of the prostate, so that a true seminal vesicle is absent. Prostate (fig. 30, *c*) as in *Gnesioceros*, elongate with transverse glandular chambers and thick muscle coat. The chambers are lined with eosinophilous gland cells borne on connective tissue parti-

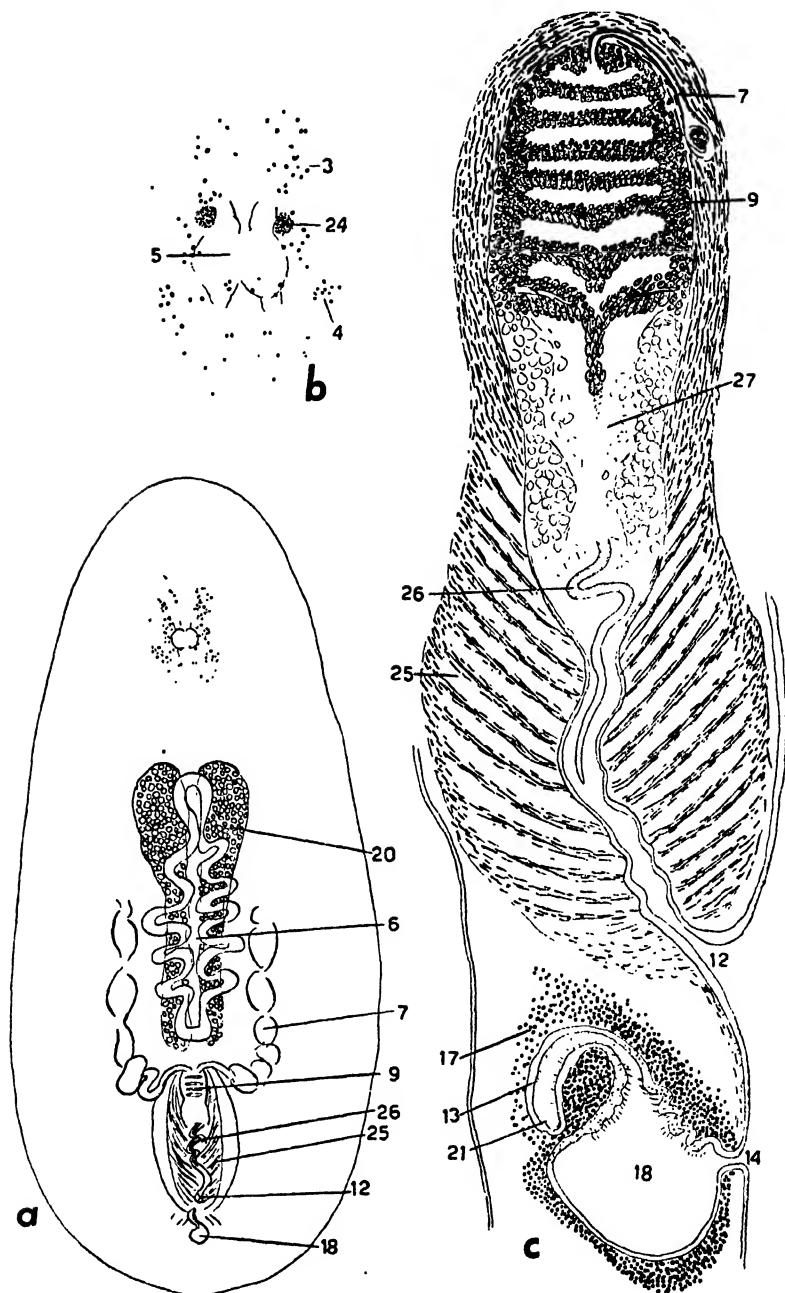


FIGURE 30.—*a*, *Planctoplanella atlantica*, new genus and species, type; *b*, eyes of *P. atlantica*, same specimen as fig. 30, *a*; *c*, copulatory complex of *P. atlantica*, from sagittal sections made from sexual region of specimen shown in fig. 30, *a*. (See p. 492 for index to numbered parts.)

tions. The prostate continues directly into a chamber lined by an indefinite tissue containing large cyanophilous masses (fig. 30, *c*), and this is continuous with the cirrus sac. Latter has thick muscular wall of radiating fibers and sinuous canallike lumen, which contains the vermiform cirrus papilla, a long slender sinuous structure, which takes its origin from the cyanophilous chamber just mentioned (fig. 29, *a*). Cirrus papilla appears to have no cellular structure but to be a hollow tube with a cuticularized wall. It is filled with eosinophilous granules, apparently coming from the prostate. Lumen of cirrus sac lined by ordinary epithelium; no cuticularized structures, except the cirrus papilla, could be found in male apparatus.

Female pore separate from, shortly behind male pore; leads into nonmuscular vagina greatly expanded into cement pouch, surrounded by numerous cement glands (fig. 30, *c*). Anterior wall of cement pouch has thickened sinuous epithelium, which receives most of cement glands; from this region vagina continues dorsally as a narrowed tube, which curves backward and receives uteri at its posterior end; Lang's vesicle lacking. Uteri form enlarged canals alongside pharynx, stuffed with eggs (fig. 30, *a*).

Distribution.—Taken in surface tow, 8:30–9:00 p. m., no date, Sheepshead Shoal, off Beaufort, N. C.

Habits.—Pelagic, presumably benthonic part of the time.

Type.—Whole mount, sexual region as serial sections, U.S.N.M. No. 20534; other three specimens also mounted, deposited in U. S. National Museum.

Remarks.—The male apparatus of this genus combines the characteristics of *Gnesioceros* and *Planctoplana*. The prostate with its transverse chambers closely resembles that of *Gnesioceros*, and the thick-walled cirrus sac with its canallike lumen containing a vermiform cirrus papilla suggests *Planctoplana*. In *Planctoplana*, according to Graff (1892), the cirrus papilla ("penis") has the usual histological structure but is covered and lined by a cuticularized ("chitinized") layer; in *Planctoplanella* the cirrus papilla seems to consist merely of a cuticularized tube. Unlike other genera of the Planoceridae, *Planctoplanella* is devoid of any armature of either the male or female apparatus, unless the cirrus papilla be considered as such. The powerful musculature of the cirrus sac indicates that this structure everts in copulation, bringing the cirrus papilla to the exterior.

Family ENANTIIDAE Graff, 1890

Definition.—Schematommata with tubular pharynx in anterior part of body, directed forward; tentacles absent; body margin with cuticular spines; copulatory complex immediately behind pharynx; one or two pairs of laterally extending uteri; Lang's vesicle present.

Genus ENANTIA Graff, 1890

Definition.—With the characters of the family.

ENANTIA PELLUCIDA (Pearse, 1938), new combination

Figure 31, *a*, *b*

Acerotisa pellucida PEARSE, 1938, p. 90, fig. 33.

Material.—Two whole mounts in Pearse collection labeled *Acerotisa pellucida*, one the type; other cut into sagittal serial sections.

Form.—Oval, flat, thin, delicate (see Pearse, 1938, fig. 33); size of preserved specimens given in Pearse as 7.1 by 4.3 mm. and 5.7 by 3.8 mm. No tentacles; no sucker. Margin, except anterior end, with yellow cuticular spines; in the remaining whole mount only three such spines can be seen, close together near the posterior end on one side; presumably the others have been lost. In the set of sections, about 40 such spines appear to have been present. Evidently *E. pellucida* has fewer marginal spines than *E. spinifera*. As Graff (1890) has fully described and illustrated the structure of these spines, an account of them here appears superfluous.

Eyes.—Pearse's figure and description erroneous; no marginal eyes; eyes small, in usual tentacular and cerebral groups (fig. 30, *a*, same specimen as Pearse's figure 33). Tentacular groups of about eight eyes, cerebral groups scattered, of about 10 eyes, extending forward from brain; on each side there is an eye behind each tentacular cluster.

Color.—Pale, whitish, pellucid.

Digestive tract.—Pharynx (fig. 30, *a*) short, tubular, directed forward, in anterior body fifth; from this main intestinal trunk extends posteriorly in median line, giving off a few large branches, which branch and anastomose.

Reproductive system.—Very similar to that of *E. spinifera*. Male complex immediately behind pharynx; male canal leads dorsally from male genital pore into pyriform mass, marked off from parenchyma by a muscle layer. This mass contains in its anterodorsal part the seminal vesicle, which has a muscular wall and receives from below separately the two vasa deferentia (fig. 30, *b*). Seminal vesicle discharges into a cavity containing the introverted penis papilla. The male system of *E. pellucida* thus differs from that of *E. spinifera* chiefly in that in the latter the penis is protruded, in the former introverted, probably merely a functional difference. Prostate appears entirely wanting.

Female genital pore shortly behind male pore (fig. 31, *b*); leads into long vagina, which extends posteriorly in median line, has a kink where the shell glands enter, posterior to this receives a pair of uteri, and then continues as an elongated Lang's vesicle (fig. 31, *a*,

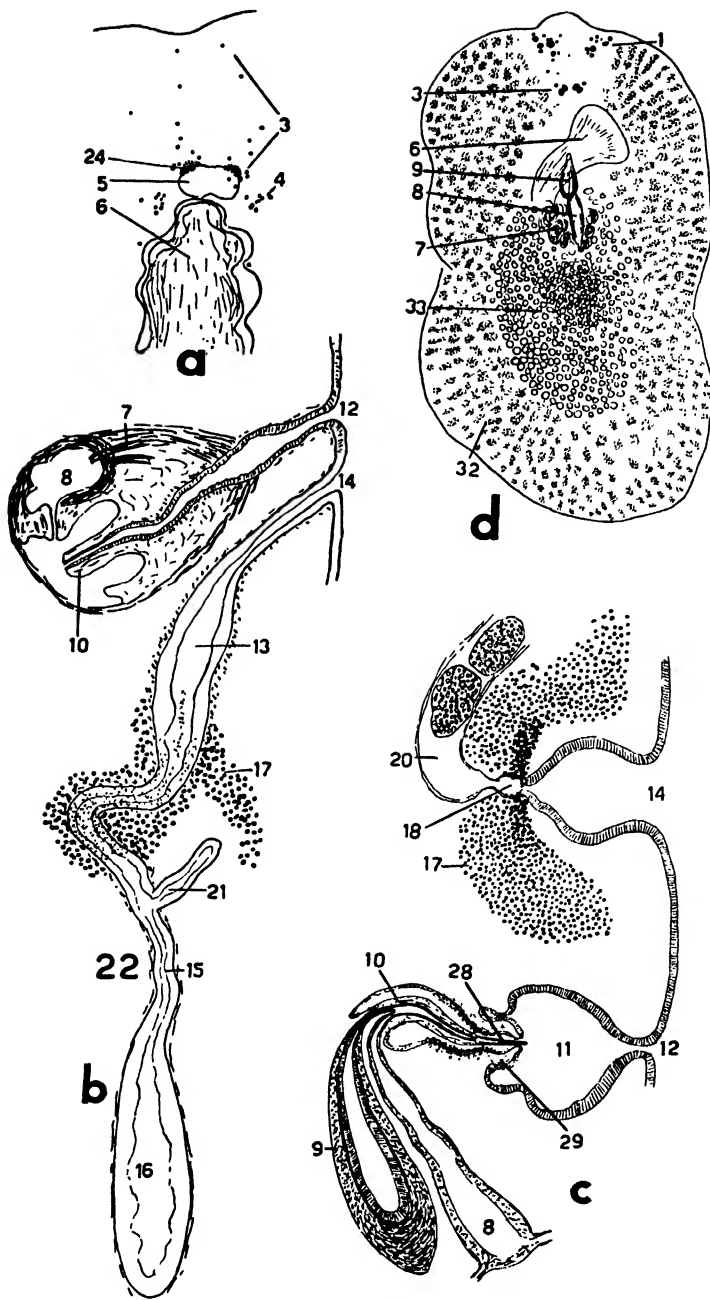


FIGURE 31.—*a*, Eye arrangement of *Enantia pellucida* (Pearse), from Pearse's whole mount, U.S.N.M. No. 20193; *b*, copulatory complex of *E. pellucida*, from sagittal sections made of Pearse's whole mount No. 307A; *c*, copulatory complex of *Oligoclado floridanus* Pearse, from set of sagittal sections in Pearse collection, No. 419; *d*, *Acerotisa baias*, new species, from Pearse's whole mount No. 430 (which has been sectioned). (See p. 492 for index to numbered parts.)

for dorsal view see Pearse's figure 33). Differs from *E. spinifera* in that there is a single pair of uteri, whereas latter has two pairs.

Distribution.—St. Vincent Bar, Apalachicola Bay, Fla.

Habits.—Not stated by Pearse.

Remarks.—Pearse regarded this species as a cotylean and therefore attributed to it a sucker, marginal eyes, and a prostate vesicle, which do not exist; he entirely overlooked the marginal spines. This species is so similar to the only other known species of the genus and family, *E. spinifera* Graff (1890), that it may be placed without hesitation in that genus. Distinctions from *E. spinifera* are noted above.

Suborder COTYLEA

Definition.—Polyclads with a sucker behind the female genital pore; tentacles when present of the marginal type; eyes on anterior margin in two groups, extending on tentacles when present; or eyes in a band along anterior margin; pharynx ruffled to tubular; uteri usually behind female genital pore; prostate when present always free; Lang's vesicle absent.

Family PSEUDOCERIDAE Lang, 1884

Definition.—Cotylea of considerable size and oval shape; tentacles broad and blunt, formed of marginal folds, bearing eyes; pharynx ruffled; gut branches numerous and anastomosed; male copulatory apparatus single or double, with a penis stylet and free prostatic vesicle; uteri branched; uterine glands often present.

Genus THYSANOZOON Grube, 1840

Definition.—Pseudoceridae in which the dorsal surface bears numerous papillae each of which contains a gut branch; male apparatus double (paired).

THYSANOZOON NIGRUM Girard, 1851

Thysanozoon nigrum GIRARD, 1851, p. 137.

Material.—Two specimens taken alive at Bermuda.

Form.—Elongated-oval shape, narrowing at anterior end to the two projecting marginal tentacles; dorsal surface with numerous papillae with rounded tips; 25–30 mm. long, 8 mm. wide when extended in locomotion.

Eyes.—Rounded cluster of cerebral eyes in median line just in front of anterior end of pharynx; eyes on tentacles indistinguishable because of black color.

Color.—Velvety black above; may have a few white flecks; dusky below.

Digestive tract.—Oval ruffled pharynx in anterior half; mouth anterior to center of pharynx.

Reproductive system.—Described in Hyman, 1939b.

Distribution.—Florida, Bermudas.

Habits.—Among stones; also swims.

Remarks.—This species was described by Girard from the eastern coast of Florida. Although it has not since been taken there, it probably still occurs. It is found sparingly at Bermuda along the causeway between Longbird and Castle Islands.

THYSANOZOOON BROCCHI (Risso, 1818)

Tergipes brochi RISSO, 1818, p. 373.

Thysanozoon brocchi GRUBE, 1840, p. 55.—PEARSE, 1938, p. 85.

Pearse (1938, p. 85) records collecting 15 specimens of a "papillate polyclad" which he identified as *Thysanozoon brocchi*, among eelgrass in Crooked Island Sound, Farmdale, Fla. Although the facts that *T. brocchi* has a wide distribution and that other Mediterranean pseudocerids occur at Bermuda make this identification at least plausible, it cannot be accepted as certain without a more detailed study. I have been unable to obtain any specimens for study.

Genus PSEUDOCEROS Lang, 1884

Definition.—Pseudoceridae without dorsal papillae, or if such are present they do not contain gut branches; otherwise very similar to *Thysanozoon*: male copulatory apparatus single or paired.

PSEUDOCEROS MACULOSUS Pearse, 1938

Pseudoceros maculosus PEARSE, 1938, p. 85, fig. 31.

Material.—One whole mount, type specimen.

Form.—Elongated oval, flat, 17 mm. long by 7 mm. wide in life; dorsal surface stated to have been roughened in life by small, low, conical papillae, more numerous toward the median line; these not detectable on whole mount. For general appearance, see Pearse (1938, fig. 31).

Eyes.—Cerebral eyes in paired semicircular clusters close together (Pearse, 1938, fig. 31D). Many tentacular eyes on medial lobe of each tentacle and median region directly behind tentacles.

Color.—Stated by Pearse to be gray with middorsal light band bordered by darker shade; small dark spots scattered evenly over the dorsal surface.

Digestive tract.—Pharynx oval, ruffled, in anterior body third, mouth central in pharynx, large main gut extends back from pharynx to about one-fourth the distance from the posterior end, giving off numerous (about 60) branches on each side, which anastomose to a network.

Reproductive system.—As only the type specimen is available, I have forbore to section it. Without sections it is impossible to furnish any details of the reproductive system beyond those given by Pearse. His figure 31B of the male copulatory apparatus appears to be correct, but as regards the female apparatus I was unable to see on the whole mount the two uterine glands which he figures.

Distribution.—Crooked Island Sound, Farndale, Fla.

Family EURYLEPTIDAE Lang, 1884

Definition.—Cotylea with pointed marginal tentacles, or tentacles reduced or lacking; pharynx tubular, anteriorly located, directed forward; male apparatus single, immediately behind or beneath the pharyngeal pocket; penis with stylet; uteri form a pair of large unbranched canals along the main gut; uterine glands few, often but two, or lacking.

Genus EURYLEPTA Ehrenberg, 1831 (emend. Lang)

Definition.—Main gut with a few (mostly three to five) branches on each side, usually not anastomosing; tentacles well developed; uterine glands usually one pair; mouth behind brain.

EURYLEPTA MACULOSA Verrill, 1893

Eurylepta maculosa VERRILL 1893, p. 495, pl. 41, figs. 2, 3.—PEARSE, 1938, p. 87.—

HYMAN, 1939a, p. 150, figs. 17, 18.

Material.—Three whole mounts made by Pearse from specimens collected by Verrill; one marked type is intact, others labeled cotypes are fragmentary.

Form.—Elliptical or oblong, thin, changeable, with thin undulated margin, 10–12 mm. long; tentacles long, bluntly pointed.

Eyes.—For figure see Hyman, 1939a, fig. 17, p. 149. Cerebral eyes in paired elongated clusters continuing as scattered eyes to anterior margin; tentacular eyes borne on lower halves of anterior faces of tentacles.

Color.—Mottled brown or purplish brown on a pale yellowish or flesh ground.

Digestive tract.—Pharynx short, tubular; main gut with about three pairs of lateral branches.

Reproductive system.—In the absence of a good specimen for serial sections, I have nothing to add to my previous account and figure (Hyman, 1939a, fig. 18, p. 149).

Distribution.—Vicinity of Woods Hole, Mass., rare.

Habits.—On piles, in mud, and among algae.

Remarks.—This species must remain imperfectly known until well-preserved material suitable for sectioning shall be forthcoming.

Genus OLIGOCLADO Pearse, 1938

Hymania PEARSE and LITTLER, 1938.

Definition.—Euryleptidae with a uterine duct on each side lateral to the uteri, running from the uterine gland to a median uterine pore directly behind the blind end of the main gut; vasa deferentia confluent behind the uterine pore; otherwise as in *Eurylepta*.

OLIGOCLADO FLORIDANUS Pearse, 1938

FIGURE 31, c

Oligoclado floridanus PEARSE, 1938, p. 88, fig. 32.—PEARSE and LITTLER, 1938, p. 241, pl. 20, fig. 8.

Hymania prytherchi PEARSE and LITTLER, 1938, p. 239, pl. 21, figs. 10-13.

Material.—Number of whole mounts, some labeled *Oligoclado floridanus*, others *Hymania prytherchi*, one set of serial sections labeled *Hymania prytherchi*, five living specimens sent from Beaufort by Dr. Pearse.

Form.—Oblong, ends rounded, or anterior end somewhat truncate, very changeable, maximum length when crawling 29 mm., width 12 mm.; tentacles long, slender, pointed, very mobile (for general appearance see Pearse and Littler, 1938, pl. 21, figs. 10, 11).

Eyes.—Cerebral eyes in paired elongated clusters; eyes on basal half of anterior faces of tentacles and also in a pair of clusters on anterior margin between tentacle bases (Pearse, 1938, fig. 32B; Pearse and Littler, 1938, figs. 11, 12, pl. 21).

Color.—Nearly white with a pinkish tinge and median deeper pink band. The colors ascribed by Pearse to this species in his descriptions of *Oligoclado floridanus* and *Hymania prytherchi* undoubtedly resulted from ingested ascidians. The five living specimens that he sent me and that had had no food for a few days had lost these colors and were almost white. It is even probable that with further starvation the remaining pinkish tints would also disappear.

Digestive system.—Pharynx tubular, mouth at anterior end of pharynx behind brain. Pearse's description of gut erroneous; there is no anus; Pearse and Littler's description of gut of "*Hymania prytherchi*" is correct. The main gut has three to several branches on each side, which may form anastomoses, especially in posterior body half; it ends blindly just in front of the uterine pore.

Reproductive system.—Description by Pearse contains several errors; that by Pearse and Littler of "*Hymania prytherchi*" is substantially correct. The course of the male ducts is correctly figured by Pearse and Littler (fig. 11, pl. 21), but the description is confused. The vasa deferentia are confluent in the posterior part of the body behind the uterine pore; they then course forward as coiled canals on

each side to the level of the posterior end of the pharynx where each turns medially, narrowing to a tube with slightly muscular wall; these enter the proximal end of the seminal vesicle. Seminal vesicle is an elongated tube with dilated proximal end, which receives the vasa deferentia; usually this end is anterior and the vesicle narrows posteriorly to its entrance into the penis; but in one whole mount, the seminal vesicle has the reverse orientation. Vesicle has muscular wall of inner circular and outer longitudinal fibers. Free prostatic vesicle lies close to and parallels seminal vesicle (fig. 31, c); is of elongated oval form with muscular wall very thick at free end, thinning towards duct (fig. 31, c). Duct of prostate and seminal vesicle join in penis base. Penis as in *Eurylepta*, elongated with terminal stylet and penis sheath; male antrum a large rounded chamber (fig. 31, c). Where vasa deferentia are confluent in median posterior region there is, according to Pearse and Pearse and Littler, a small blind diverticulum. I was able to see this on one whole mount, the type specimen of *Oligoclado floridanus*, but not on any of the others, and I was not convinced that it might not be the basal part of a branch collecting from posterior testes. Female pore shortly behind male pore; opens into somewhat expanded female antrum from roof of which narrow canal expands slightly into small cement pouch (fig. 31, c). This receives the cement glands, which form a dense eosinophilous halo around the female duct. From cement pouch, short vagina proceeds posteriorly and soon receives on either side a uterus (see Pearse and Littler, 1938, pl. 21, fig. 11). Each uterus is a thin-walled tube stuffed with eggs; it proceeds posteriorly alongside the main gut and terminates blindly near the gut end. According to Pearse and Littler the anterior part of each uterus is bifurcated, but this is probably a trivial variation. It is not shown or mentioned by Pearse in his original description of *O. floridanus*, and I was not able to discern any such condition on the type specimens of *O. floridanus* and "*H. prythorchi*." From the anterior end of each uterus there extends laterally a duct, which opens into a uterine duct, and this in turn connects by a duct with the large saclike uterine gland of that side. There is a pair of uterine glands as in *Eurylepta*. The uterine duct of each side receives a branch from in front and then proceeds posteriorly along the uterus to join its fellow of the opposite side just behind the blind posterior end of the main gut. The common duct so formed turns ventrally and opens in the midventral line by a uterine pore. These relations are figured by Pearse and Littler. The uterine glands have a very tall epithelium underlain by a few muscle strands and seem to serve for holding and digesting excess sex cells. The uterine ducts are lined by a cuboidal epithelium and have a muscle coat chiefly of circular fibers.

Distribution.—Florida to North Carolina.

Habits.—Restless, changeable, on wharf pilings associated with ascidians on which it feeds; also on shells in shallow water.

Remarks.—An examination of the type specimens of *Oligoclado floridanus* and *Hymania prytherchi* as well as of a number of other whole mounts labeled with these names, together with some sets of serial sections, has shown that the two species are identical and hence *H. prytherchi* becomes a synonym of *O. floridanus*. This species is close to *Eurylepta* (not to *Oligoclados* as supposed by Pearse) and in fact differs from *Eurylepta* only in the presence of a pair of uterine ducts, which extend from the uterine glands to a common pore in the rear part of the body. It must be emphasized, however, that these ducts and the pore are present only in the largest, maturest specimens, and individuals that have uteri full of eggs and masses of sperm in the vasa deferentia still may show no traces of them. They apparently appear only when breeding is at its height. Now it is quite possible that these structures also exist in *Eurylepta* and have been overlooked through a lack of fully ripe material. In fact, it must be admitted that the available descriptions and figures of the reproductive system of species of *Eurylepta* are none too satisfactory. I therefore feel that the genus *Oligoclado* does not as yet rest on a firm basis.

Genus ACEROTISA Strand, 1928

Accros LANG, 1884.

Definition.—Euryleptidae without tentacles, with a pair of eye groups on the anterior margin in the sites of tentacles; with paired cerebral eye clusters of few eyes; male apparatus typically euryleptid; small to minute forms.

ACEROTISA BAIÆ, new species

FIGURE 31, *d*

Material.—One whole mount in Pearse collection, slide No. 430, labeled *Prosthlostomum lobatum?*, cut into serial sections; in very bad condition.

Form.—Roughly oblong (fig. 31, *d*) 3.2 mm. long by 1.8 mm. wide, preserved; without tentacles; sucker could not be found.

Eyes.—Pair of eye clusters on anterior margin, each cluster of about 4 or 5 larger eyes and several very small ones (fig. 31, *d*); cerebral groups consist each of two large eyes, with one or two small ones.

Color.—Unknown.

Digestive tract.—Typical bell-shaped pharynx in usual anterior position, directed forward, torn from its attachment (fig. 31, *d*); intestinal branches could not be discerned.

Reproductive system.—Specimen fully mature but reproductive system much damaged; center of specimen filled with a mass of eggs, apparently from ruptured uteri; periphery showed numerous testes (fig. 31, *d*). Beneath and behind pharynx male copulatory apparatus could be seen in whole mount; sections showed it to be typical of the genus *Acerotisa*, but stylet, male antrum, and penis sheath were missing. Penis below pharynx; penis papilla elongated; free prostatic vesicle of oval form with moderately muscular wall; coiled mass of vasa deferentia could be seen around proximal end of seminal vesicle. Nothing of the female apparatus was discernible except a dense cloud of cement glands shortly behind the penis.

Differential diagnosis.—Size, number of eyes in eye clusters, and tubular seminal vesicle serve to distinguish this species.

Distribution.—St. Josephs Bay, Fla.

Type.—One set of serial sections (2 slides), U.S.N.M. No. 20535.

Remarks.—The lack of tentacles, eye arrangement, and euryleptid male apparatus leave no doubt that this species belongs to the genus *Acerotisa*, despite the imperfect condition of the specimen. Bock (1922) has pointed out that cerebral clusters composed of just two large eyes (with or without accompanying small eyes) occur in several cotylean genera (*Stylostomum*, *Acerotisa*, *Chromoplana*) and are also characteristic of young pseudocerids, so that they are probably of ancestral significance. In the genus *Acerotisa* such cerebral clusters are known for *A. inconspicuus* (Lang, 1884), *A. notulata* (Bosc, 1801) (for description see Hyman 1939b), and the present species.

Family PROSTHIOSTOMIDAE Lang, 1884

Definition.—Cotylea of elongate slender form, without tentacles; pharynx in anterior body half, long and tubular, directed forward, mouth at anterior end of pharynx, just behind brain; with a band of eyes along the anterior margin, paired cerebral clusters also present; male copulatory apparatus with two spherical accessory vesicles; penis with a stylet.

Genus PROSTHIOSTOMUM Quatrefages, 1845

Definition.—With the characters of the family.

PROSTHIOSTOMUM LOBATUM Pearse, 1938

Prosthiostomum lobatum PEARSE, 1938, p. 91, fig. 34.

Material.—Many whole mounts labeled *Prosthiostomum lobatum*; set of serial sections made from one of these.

Form.—Slender, elongated, anterior end rounded, posterior end obtusely pointed; maximum length 17 mm., width 2.7 mm. (measured alive by Pearse).

Eyes.—Band along anterior margin usually distinctly paired, narrow median region without eyes; about 30–75 eyes in band on each side; band extends around sides of anterior end to level somewhat behind brain. Cerebral eyes in paired elongated clusters of about 10–20 eyes each (Pearse, 1938, fig. 34).

Color.—Cream color or dirty white, yellowish brown toward median line.

Digestive system.—Figured by Pearse, 1938, fig. 34.

Reproductive system.—One of Pearse's specimens was sectioned, but the sections were so poor that I am not able to add anything to his account and figure of the reproductive system (1938, fig. 34). The members of this genus are almost identical in the details of the sexual system.

Distribution.—Florida to North Carolina.

Habits.—Associated with sponges, shells, oysters, and pile animals.

Remarks.—The species of *Prosthiostomum* are very difficult to distinguish. *P. lobatum* appears to be a valid species of the genus; it differs from most members of the genus in the paired arrangement of the eyes of the marginal band, although this is not evident in every specimen.

SPECIES OF UNCERTAIN POSITION

In this paper all the species of Girard and all but one of the species of Verrill are accounted for and allocated to the proper genera. It is impossible at present to evaluate *Stylochus crassus* Verrill, 1892. It was described from a single specimen taken by the *Albatross* at 6,900 feet off the Maryland coast. As Verrill gave no figures, little can be decided about it until some fortunate chance shall yield another specimen.

INDEX TO NUMBERS ON THE FIGURES

All drawings of eyes were made with the camera lucida. For all the figures (fig. 24-31) the following numbers apply for the various parts illustrated:

- | | |
|------------------------------|--|
| 1. Marginal eyes. | 19. Common genital pore. |
| 2. Frontal eyes. | 20. Uterus. |
| 3. Cerebral eyes. | 21. Entrance of uteri into vagina. |
| 4. Tentacular eyes. | 22. Small prostatic apparatuses (adenoids). |
| 5. Brain. | 23. Large prostatic apparatuses (prostatoids). |
| 6. Pharynx. | 24. Mass of granules associated with brain. |
| 7. Vas deferens. | 25. Cirrus sac. |
| 8. Seminal vesicle. | 26. Cirrus papilla. |
| 9. Prostatic vesicle. | 27. Cyanophilous chamber. |
| 10. Penis papilla. | 28. Penis stylet. |
| 11. Male atrium. | 29. Penis sheath. |
| 12. Male genital pore. | 30. Ductus vaginalis. |
| 13. Vagina. | 31. Extra female genital pore. |
| 14. Female genital pore. | 32. Testes. |
| 15. Stalk of Lang's vesicle. | 33. Mass of eggs. |
| 16. Lang's vesicle. | |
| 17. Cement glands. | |
| 18. Cement pouch. | |

LITERATURE CITED

BERGENDAL, DAVID.

1893. Einige Bemerkungen über *Cryptocellides loventi* mihl. Lunds Univ. Års-Skrift, vol. 29 (Physiogr. Sällsk. Handl., vol. 4, art. 7, 7 pp.).

BOCK, SIXTEN.

1913. Studien über Polycladen. Zool. Bidrag Uppsala, vol. 2, pp. 31-344, 67 figs., 8 pls.
1922. Two new cotylean genera of polyclads from Japan and remarks on some other cotyleans. Arkiv. Zool., vol. 14, pp. 1-31, 2 pls.
1925. Planarians, pts. 1-3. Paper No. 25 from Dr. Th. Mortensen's Pacific Expedition, 1914-16. Vid. Medd. Dansk Naturh. Foren. København, vol. 79, pp. 1-84, 3 pls.

DIESING, KARL MORITZ.

1861. Revision der Turbellarien. Abtheilung: Dendrocoelen. Sitzber. Akad. Wiss. Wien, math.-nat. Klasse, vol. 44, pp. 485-578.

GIRARD, CHARLES FRÉDÉRIC.

1850. Descriptions of several new species of marine Planariae from the coast of Massachusetts. Proc. Boston Soc. Nat. Hist., vol. 3, pp. 251-256, 264-265.
1851. Description of a new Planaria and a new Nemertes from the coast of Florida. Proc. Boston Soc. Nat. Hist., vol. 4, p. 137.
1853. Descriptions of new nemerteans and planarians from the coast of the Carolinas. Proc. Acad. Nat. Sci. Philadelphia, vol. 6, pp. 365-367.
1854. In William Stimpson: Synopsis of the marine Invertebrata of Grand Manan or the region about the mouth of the Bay of Fundy, New Brunswick. Smithsonian Contr. Knowl., vol. 6, pp. 27-28, 1 pl.
1893. Recherches sur les planariés et les némerertiens de l'Amerique du Nord. Ann. Sci. Nat., ser. 7, vol. 15, pp. 145-310, 4 pls.

GRAFF, LUDWIG VON.

1890. *Enantia spinifera*, der Repräsentant einer neuen Polycladen-Familie. Mitt. nat. Verein. Steiermark, vol. 26, pp. 3-16, 1 pl.

GRUBE, ADOLPH EDUARD.

1840. Actinien, Echinodermen und Würmer des Adriatischen und Mittelmeers nach eigenen Sammlungen beschreiben, 92 pp., 1 pl. Königsberg.

HASWELL, WILLIAM ATCHESON.

1907. Observations on Australasian polyclads. Trans. Linn. Soc. London, vol. 9, pp. 465-485, 3 pls.

HYMAN, LIBBIE HENRIETTA.

- 1939a. Some polyclads of the New England coast, especially of the Woods Hole region. Biol. Bull., vol. 76, pp. 127-152, 5 pls.
1939b. Acoel and polyclad Turbellaria from Bermuda and the *Sargassum*. Bull. Bingham Oceanogr. Foundation, vol. 7, art. 1, 26 pp., 9 pls.

LAIDLAW, FRANK FORTESCUE.

1902. The marine Turbellaria, with an account of the anatomy of some of the species. Fauna and Geography of the Maldive and Laccadive Archipelagoes, vol. 1, pt. 3, pp. 282-312, 2 pls.
1903a. On a collection of Turbellaria Polycladida from the Straits of Malacca. (Skeat Expedition, 1899-1900.) Proc. Zool. Soc. London, 1903, pt. 1, pp. 301-318, 7 figs., 1 pl.
1903b. Suggestions for a revision of the classification of the polyclad Turbellaria. Mem. and Proc. Manchester Lit. and Philos. Soc., vol. 48, pt. 1, No. 4, 16 pp., 5 figs.

LANG, ARNOLD.

1884. Die Polycladen (Seeplanarien) des Golfes von Neapel. Fauna und Flora des Golfes von Neapel, monogr. 11, 688 pp., 54 figs., 39 pls.

MEIXNER, ADOLF.

1907. Polycladen von der Somaliküste, nebst einer Revision der Stylochinen. Zeitschr. wiss. Zool., vol. 88, pp. 385-498, 2 figs., 5 pls.

MÜLLER, OTTO FREDERIK.

1776. Zoologiae Danicae prodromus, seu Animalium Daniae et Norvegiae indigenarum characteres . . . , xxxii + 282 pp.

ØSTED, ANDERS SANDØE.

1843. Forsøg til en ny classification af Planarierne (Planariea Dugès) grundet paa mikroskopisk-anatomiske undersøgelser. Naturh. Tidsskr., vol. 4, pp. 519-582.

1845. Fortegnelse over dyr, samlede i Christianifjord ved Drøbach fra 21-24 Juli 1844. Naturh. Tidsskr., new ser., vol. 1, pp. 400-427, 1 pl.

PALOMBI, ARTURO.

1931. *Stylochus inimicus* sp. nov. Polyclade acotileo commensale di *Ostrea virginica* Gmelin delle coste della Florida. Boll. Zool., vol. 2, pp. 219-226, 4 figs., 1 pl.

1936. Polycladi liberi e commensali raccolti sulle coste del Sud Africa, della Florida e del Golfo di Napoli. Arch. Zool. Ital., vol. 23, pp. 1-45, 27 figs., 1 pl.

PEARSE, ARTHUR SPERRY.

1938. Polyclads of the east coast of North America. Proc. U. S. Nat. Mus., vol. 86, pp. 67-98, 13 figs.

PEARSE, ARTHUR SPERRY, and LITTLER, J. W.

1938. Polyclads of Beaufort, N. C. Journ. Elisha Mitchell Sci. Soc., vol. 54, pp. 235-244, 4 pls.

PEARSE, ARTHUR SPERRY, and WALKER, ALMEDA M.

1939. Littoral polyclads from New England, Prince Edward Island, and Newfoundland. Bull. Mount Desert Island Biol. Lab., 1939, pp. 15-22, 1 fig.

PEARSE, ARTHUR SPERRY, and WHARTON, GEORGE WILLARD.

1938. The oyster "leech," *Stylochus inimicus* Palombi, associated with oysters on the coast of Florida. Ecol. Monogr., vol. 8, pp. 605-655, 37 figs.

PLEHN, MARIANNE.

1896. Neue Polycladen, gesammelt von Herrn Kapitän Chierchia bei der Erdumschiffung der Korvette Vettor Pisani, von Herrn Prof. Dr. Kükenthal im nördlichen Eismeer und von Herrn Prof. Dr. Semon in Java. Jen. Zeitschr. Naturw., vol. 30, pp. 137-176, 6 pls.

RISSE, ANTOINE.

1818. Mémoire sur quelques gastéropodes nouveaux, nudibranches et tectibranches, observés dans la mer de Nice. Journ. Phys., Chimie, Hist. Nat., et Arts, vol. 87, pp. 368-377.

STIMPSON, WILLIAM.

1857. Prodrum descriptionis animalium evertibratorum quae in expeditione ad Oceanum Pacificum septentrionalem a Republica Federata missa, Johanne Rodgers duce, observavit et descripsit. Proc. Acad. Nat. Sci. Philadelphia, vol. 9, pp. 19-31.

STRAND, EMBRICK.

1923. *Miscellanea nomenclatoria zoologica et paleontologica*. Arch. Naturg., vol. 92A, pp. 30-75.

STUMMER-TRAUNFELS, RUDOLF VON.

1933. *Ergänzende Untersuchungen zum Literatureverzeichnis*. In H. G. Bronn's *Klassen und Ordnungen des Tier-Reichs*, vol. 4, pp. 3485-3566, 138 figs.

VERRILL, ADDISON EMORY.

1873. Report upon the invertebrate animals of Vineyard Sound and adjacent waters, with an account of the physical characters of the region. Rept. U. S. Comm. Fish and Fisher., 1871-72, pp. 295-778, 4 figs., 38 pls.
1882. Notice of the remarkable marine fauna occupying the outer banks of the southern coast of New England, No. 7, and of some additions to the fauna of Vineyard Sound. Amer. Journ. Sci., ser. 3, vol. 24, pp. 360-371.
- 1892-1893. Marine planarians of New England. Trans. Connecticut Acad. Arts and Sci., vol. 8, pp. 459-520, 2 figs., 5 pls.

WHEELER, WILLIAM MORTON.

1894. *Planocera inquilina*, a polyclad inhabiting the branchial chamber of *Sycotypus canaliculatus* Gill. Journ. Morph., vol. 9, pp. 195-201, 2 figs.

issued



by the

SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1940

No. 3102

NEW SPECIES OF HETEROCEROUS MOTHS IN THE
UNITED STATES NATIONAL MUSEUM

By WILLIAM SCHAUS

IN working over the lepidopteran collections in the United States National Museum I have found a number of species of heterocerous moths that appear to be new to science and heretofore unnamed. Most of the specimens from southern Brazil, as well as the Sphingidae, were generously donated by Frank Johnson. Part of the Colombian material is from the Dognin collection, which is now a part of the national collection.

Family SPHINGIDAE

Genus **PROTOPARCE** Burmeister

PROTOPARCE MARICINA, new species

Male.—Palpus and thorax above pale drab; palpus underneath white divided by a black line; thorax and abdomen below white, the thorax with faint dark lines, the abdomen with medial black points on segments; abdomen above pale smoke gray; subdorsal triangular spots, the three terminal segments with fine black lines. Fore wing pale drab-gray, with some darker suffusions and some fine darker lines; a small white spot edged with fine black lines; antemedial line fine, double, dark wavy and inbent to inner margin; medial line double, outbent, with dark lines and filled in with dark scaling, not extending below vein 3 and with a short black streak on veins 3 and 4; a postmedial curved series of white points, sinuous below vein 3, each point edged with dark gray; apical space broadly pale smoke

gray; the tornal space with some white points; a subterminal black line from costa curved to termen below apex; cilia white with black points. Hind wing fuscous with subterminal black streaks; inner margin narrowly white. Fore wing below ecru-olive with darker medial and postmedial bands cut by veins, the termen also darker; inner margin broadly white; the costa narrowly white at base; cilia white with black points as above. Hind wing below paler; a medial and postmedial series of small darker points, the termen broadly darker.

Expanse: 100 mm.

Habitat.—Valera, Venezuela.

Type.—U.S.N.M. No. 34754.

PROTOPARCE HUASCARA, new species

Male.—Palpus and front of head fuscous with lighter shading; head posteriorly with short white streaks. Palpus below with grayish and fuscous streaks, collar chaetura drab tipped posteriorly with whitish, patagia covering thorax pale purplish gray, with some white mottling and dark lines; base of abdomen deep purplish gray, somewhat paler on medial segments, the three terminal segments pale purplish gray, some dark segmental lines on medial segments, a black subdorsal irregular line, somewhat dentate on basal segments enclosing large white spots followed by a lateral wavy white line; abdomen below white with grayish mottling terminally. Fore wing: Base of costa with black spots; two small white spots at base in and below cell, followed by black scaling; an antemedial grayish space, incurved from costa, outwardly edged by a double sinuous black line, partly filled in with wood brown, well inbent and ending in a dark shade on inner margin; a medial dark olive-buff shade partly black-edged and parallel with the antemedial double line, this fascia followed by a broad whitish space crossed by two narrow lunular lines, well incurved and reduced to one below vein 4; the subterminal line black, very fine on costa followed by a triangular dark patch; large oblique light gray spots from apex below vein 5 a terminal irregular dark space abruptly downbent and expanding as a broad black line to inner margin at tornus and outwardly broadly edged with white. Hind wing black, the costal margin white not reaching termen; a white streak along inner margin; a short white streak above anal angle, above it a faint grayish spot. Fore wing below: Costal margin grayish on basal half; inner margin white; termen broadly benzo brown; medial space benzo brown crossed by a fuscous line; a broad postmedial brownish gray shade crossed by an indistinct subterminal line. Hind wing below yellowish white; termen broadly benzo brown and a similar narrower fascia; a macular narrow dark line, the markings at anal angle as above.

Expanse: 110 mm.

Habitat.—Colombia.

Type.—U.S.N.M. No. 34755.

Genus **XYLOPHANES** Hübner

XYLOPHANES CANTEL, new species

Male.—Palpus vinaceous; collar and thorax medially verona brown; a white line from head becoming pinkish gray, with a black line laterally on thorax; metathorax laterally with pinkish suffusions; abdomen dorsally at base seal brown, the following segments dull smoky gray, with broken black lines and isolated points, laterally roseate; underneath pale congo pink. Fore wing with the lines more intensely marked than in *katharinae* Clark; the subterminal fascia on hind wing is reduced to a few spots near anal angle. The underside is similar to other species, and they all belong to one group.

Expanse: 95 mm.

Habitat.—Mexico.

Type.—U.S.N.M. No. 34756.

Family **SATURNIIDAE**

Genus **ROTHSCHILDIA** Grote

ROTHSCHILDIA MUSSEHLI, new species

Male.—Antennae yellowish; vertex fuscous; collar anteriorly white, posteriorly and thorax blackish red-purple; a white band across base of abdomen; abdomen otherwise mahogany red above; a fine white dorsal line; a sublateral broader white line with black points on segments, between the lines transverse black lines on segments; abdomen below with a medial double roseate line not reaching base or anal segment. Fore wing: A large grayish purple patch at base edged by a fine and irregular antemedial white line from costa to inner margin; medial space blackish red-purple to a postmedial incurved white line from costa interrupted by the point of a large hyaline spot, which is excurved on basal side below the interrupted point of the postmedial line; it continues wavyly inbent to inner margin where it contacts with the postmedial line of the hind wing; the apex of fore wing is broadly extended and somewhat paler than the medial space; from the apex a white and pinkish line is wavyly inbent toward the incurve of the postmedial line and is edged below by an irregular black line which becomes double, edging a series of buffy-citrine spots including the termen; at apex the termen is paler. Hind wing: The base of inner margin somewhat paler with the edge pinkish white; medial space as on fore wing, the postmedial very wavy and dentate, medially touched by the point of a large hyaline spot, less excurved than the spot on the fore wing; subterminal space broadly aegus brown, paler toward inner

margin, outwardly edged by some black spots and a few white scales before the inner margin; termen dark citrine with a series of smoke black spots and a fine black line; the costal margin of hind wing is broadly grayish but is concealed by the fore wing. Fore wing below as above without the basal patch. Hind wing below as above, the costal margin narrowly white and connected with the postmedial line; the terminal broad space brighter in color, but the termen as above.

Named for a very fine coworker, Chester Mussehl.

Expanse: 110 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34752.

ROTHSCHILDIA BUCAYA, new species

Female.—Antenna antimony yellow. Head vinaceous-brown; vertex and collar partly white, the latter posteriorly and thorax brown; metathorax acajou red; two dorsal white spots at base of abdomen, the following segments purple-drab with dark segmental lines, somewhat rubbed, the last two segments ecru-drab; a broad white line sublaterally, with a dark reddish point on each segment; legs largely lilacine. Fore wing: Costal margin pale mouse gray, with fine darker irrorations; wing otherwise to the postmedial white line raw umber; an antemedial outwardly white line, inwardly edged by a large hyaline spot, its lower edge curved; vein 3 with a whitish line. The postmedial white line vertical and wavy followed by a slight reddish line and a broader pale brownish-drab shade with whitish irrorations; this is followed from vein 7 to inner margin by a lunular black line on its outer edge, enclosing a dark lavender spot on each interspace; from vein 7 to inner margin a subterminal pale brownish drab irregular fascia edged by a fine, irregular, black line; terminal space on apex brownish drab, with some fuscous streaks beyond the postmedial white line, a fine white line from apex inbent to vein 7, beyond on vein 7 a cluster of black spots; termen whitish tipped with avellaneous. Hind wing: Medial space as on fore wing; an excurved oblique line, partly white from costa to inner margin at one third from base enclosing a black streak and reddish scaling; inner margin to postmedial line roseate; an ovate hyaline spot, its point touching the postmedial line as on fore wing but downbent from inner margin above anal angle. The lunular black line beyond the postmedial is much wider than on fore wing and downbent on veins; termen whitish, below costa fine, obliquely lunular, toward anal angle slightly linear with narrow black spots, above vein 4 with red points and gray scaling; marginal fine black wavy line; termen dark olive buff. Fore wing below very similar to upperside, the fore wing without the antemedial curved line; the costal margin as above; inner margin suffused with pale mouse gray. Hind wing as above, the costal margin white divided by a fine roseate line.

A large square-winged species. Expanse: 112 mm.

Habitat.—Bucay, Ecuador.

Type.—U.S.N.M. No. 34753.

Genus AUTOMERIS Hübner

AUTOMERIS HOSMERA, new species

Male.—Antennae cinnamon-rufous; palpi and head dark olive-buff; collar and thorax buffy brown, somewhat paler on metathorax; abdomen dorsally with segmental black tufts edged with dull bluish hairs and with a paler lateral line; underneath as above. Fore wing falcate, buffy brown, the lines fine, pale purple-drab; an antemedial vertical line; a large postmedial irregular line forming a somewhat quadrate spot; a line from middle of inner margin to apex edged below by a dark line; some pale shading on termen medially. Hind wing with darker shading on inner margin; a very large round spot above inner margin, black outwardly edged by a fine pinkish line, inwardly edged with reddish scales and a few white scales, in the center with a broad black streak; termen with a fine black subterminal line, below it a narrow purplish shade, the terminal edge and cilia dull grayish. Fore wing below dark olive-buff with vinaceous-buff suffusions; a medial large black spot containing a small white spot; a sinuous black line from middle of inner margin to apex where it is edged on costa with a dark shade; the termen with some darker shading. Hind wing below light brownish drab; a faint dark postmedial line, above it a white point; some faint dark streaks subterminally on interspaces.

Expanse: 102 mm.

Habitat.—Juan Vinas, Costa Rica.

Type.—U.S.N.M. No. 34751.

Larger than *Automeris leucane* Hübner; and the spot on hind wing different.

Family ARCTIIDAE

Genus HALISIDOTA Hübner

HALISIDOTA ZACUALPANA, new species

Male.—Antenna with long pectinations, the stalk white; palpi short, black; head and collar olive-yellow; thorax with darker hairs; patagia reed yellow; abdomen above olive-yellow, with broken dark segmental lines, underneath with darker suffusions. Wings marguerite yellow, the fore wing with ecru-olive streaks along cell, broken and narrower toward apex; a short streak above inner margin; veins darker, the outer space with deeply curved lines on interspaces and a terminal line between the veins. Hind wing with faint darker shading

along inner margin and few faint darker spots at costal edge. Wings below with faint traces of the markings on the upper side.

Expanse: 55 mm.

Habitat.—Zacualpan, Mexico.

Type.—U.S.N.M. No. 34757.

From the Dognin collection.

HALISIDOTA BIEDALA, new species

Male.—Head and collar lemon-chrome; thorax with ill-defined black and brown hairs; patagia deep colonial buff; abdomen Naples yellow, the underside and anal hair white. Fore wing narrow, the termen oblique, stronthian yellow, with sulphine-yellow irrorations forming small antemedial spots; a medial outcurved shade with a branch from it to termen below apex; a wavy postmedial line and subterminal small spots on interspaces; the cilia mottled with dark lines. Hind wing amber-yellow, the cilia white. Fore wing below amber-yellow, with traces of the markings on upperside. Hind wing below as above.

Expanse: 46 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34758.

HALISIDOTA TEROLA, new species

Male.—Head and collar cream-buff; thorax with a medial and lateral black lines; patagia and abdomen above deep colonial buff, the latter with short, darker, segmental lines, underneath cream-buff. Fore wing long and narrow, deep colonial buff, with dull grayish suffusions forming a broad fascia from cell to apex and numerous dark brown points and irregular lines, those on subterminal space deeply angled, others on termen small. Hind wing marguerite yellow. Fore wing below marguerite yellow, with a brownish-gray fascia from cell to apex, the terminal half with numerous dark points and spots. Hind wing below as above, the medial space faintly darker.

Expanse: 50 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34759.

HALISIDOTA LOUELLA, new species

Female.—Head and collar chamois; patagia cream-buff, the thorax apparently black; abdomen above honey yellow, with brown and greenish segmental lines, underneath white. Fore wing chamois, the veins finely paler; a fine sulphine-yellow streak from within cell not reaching termen and a similar streak along vein 2; from apex to vein 2, a series of subterminal large linear round spots on interspaces. Hind wing white, somewhat hyaline. Fore wing below with faint indications of terminal markings.

Expanse: 40 mm.

Habitat.—Esperito Santo, Brazil.

Type.—U.S.N.M. No. 34760.

No paratypes.

HALISIDOTA LOISONA, new species

Female.—Palpi dark brown with black tip; head and collar light brownish vinaceous; thorax black, the patagia mostly white, showing on outer edge a black line. Abdomen above with alternate black and greenish segmental lines, underneath whitish gray with a fine black subdorsal broken line. Fore wing pale vinaceous-brown, with darker veins and small black irrorations; a black spot with pale center at end of cell; subterminal black lunular spots on interspaces, mostly double, black, preceded by postmedial fine angled lines, also terminal black spots at cilia; a faint dark line from spot at end of cell to apex. Hind wing somewhat hyaline, greenish with slightly darker suffusion on inner half of wing with terminal black spots on interspaces; a larger black spot at vein 6. Wings below with markings on wings less distinctly indicated.

Expanse: 55 mm.

Habitat.—Espírito Santo, Brazil.

Type.—U.S.N.M. No. 34761.

No paratypes.

HALISIDOTA DALTONA, new species

Male.—Palpi black; head and collar light purplish vinaceous; thorax fuscous almost completely covered by the white patagia; metathorax dull green; abdomen above dull roseate with black spots on segments, the anal hairs dull green; a subdorsal punctiform black line and black lines on central segments. Fore wing pale vinaceous-fawn, with irregular black points antemedially and on subterminal interspaces; a postmedial slightly darker shade angled with a branch extending toward apex. Hind wing semihyaline, with a faint greenish shade more prominent on interspaces; terminal black points on veins. Wings below faintly greenish, with traces of markings on upper side.

Expanse: 42 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34762.

HALISIDOTA ISHIMA, new species

Male.—Head and collar olive-ocher, the latter with two large black spots; thorax apparently with black hairs almost entirely covered by the marguerite-yellow patagia; abdomen dorsally the same, with transverse dark lines, underneath reed yellow. Fore wing marguerite yellow, with two black spots on costa near base and an irregular series of dark spots postmedially and subterminally on interspaces,

also small spots on cilia; a white spot edged with black at end of cell and a narrow streak of dark spots from cell to apex, underneath pale dull yellow-green, the small black spots on costa and terminal interspaces black and distinct, the veins tipped with black scales. Hind wing above and below pale dull green-yellow, with superposed black spots on interspaces. Fore wing and hind wing broad.

Expanse: 45 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34763.

HALISIDOTA AUSTINA, new species

Male.—Palpi amber-yellow, with a lateral black line; head and collar light vinaceous-fawn; thorax slightly paler; patagia whitish dorsally edged with fuscous hairs. Abdomen primuline yellow, with darker segmental lines. Fore wing straw yellow sparsely irrorated with pale brownish scales; subterminal small darker crescents on interspaces; a black point at veins 4 and 5. Hind wing semihyaline straw yellow, the cilia white. Wings below straw yellow, the markings of fore wing less distinct.

Expanse: 50 mm.

Female.—Similar to the male. Expanse: 55 mm.

Habitat.—Santa Catharina and Hansa Humboldt, Brazil.

Type.—U.S.N.M. No. 34764.

One paratype.

HALISIDOTA SOLDINA, new species

Female.—Head and collar light vinaceous-lilac, a black line on head and collar, the latter with dark-brown hair posteriorly; thorax with black hairs, patagia white, edged by black lines; abdomen reddish at base becoming darker with dark segmental lines, the anal hairs whitish, underside with dark shading on terminal half. Fore wing reed yellow, the costa with black spots; a small black spot at end of cell; postmedial and subterminal small dark spots on interspace; some dark mottling on cilia. Hind wing mostly reed yellow, the inner margin with darker suffusions along inner margin. Fore wing below reed yellow, the costa with dark streaks, the spots on terminal half black. Hind wing below with darker suffusions only the costa and termen whitish green.

Expanse: 54 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34766.

HALISIDOTA JOASA, new species

Male.—Head and collar pinkish buff with black spots on collar; patagia warm buff dorsally edged with black, covering the thorax; abdomen alternately orange-vinaceous and warm buff, the two anal

segments white. Fore wing mustard yellow; the costa with cinnamon-drab streaks except at base, otherwise with fine transverse dark lines, a small black spot at end of cell and a narrow brownish streak from base to termen at apex; cilia greenish white. Hind wing primrose yellow, the termen broadly white, faint darker suffusions on inner margin. Wings underneath primrose yellow, with the line to apex and the subterminal lines faintly indicated. The fore wing rather narrow, the termen oblique, the hind wing broad.

Expanse: 45 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34767.

HALISIDOTA AZADINA, new species

Female.—Head and collar deep colonial buff; thorax and patagia ivory yellow; abdomen above colonial buff, with short dark streaks dorsally, the anal hairs white; subdorsal black points. Wings marguerite yellow. Fore wing with veins finely darker and some very faint irrorations on terminal half. Hind wing with faintly darker patches on interspaces subterminally. Wings below as above.

Expanse: 64 mm.

Habitat.—São Paulo, Brazil.

Type.—U.S.N.M. No. 34768.

HALISIDOTA GUASCANA, new species

Male.—Antenna with long pectinations, black, head pallid brownish drab broken by a black spot; patagia colonial buff, thorax evidently with dark hairs; abdomen black, the anal segment with white hairs, underneath buffed with dark segmental lines. Fore wing olive-yellow, with a few minute black points, two larger subterminal points toward apex and a small spot at end of cell; traces of streaks above inner margin and from end of cell all very vague. Hind wing with costal half olive-yellow, with dark terminal streaks on and between vein, the inner margin broadly deep olive-brown. Fore wing below paler with similar but fainter markings. Hind wing below with two thick streaks from base of inner margin, the terminal markings on outer margin as above.

Expanse: 60 mm.

Habitat.—Pueblo Guasca, Colombia.

Type.—U.S.N.M. No. 34765.

HALISIDOTA CLOISA, new series

Female.—Palpi black; head and patagia cream-buff, the collar brownish; a dark line on thorax; abdomen above purplish black with paler segmental lines, the anal tufts white. Fore wing pale purplish yellow (not in Ridgway); a faint darker streak medially below vein

3, with shorter streaks on interspaces postmedially; a minute black point at end of cell with small cluster of black scales subterminal and along termen; the cilia white. Hind wing dark olive lake, with pale subfuscous below at costa on terminal half; cilia white. Fore wing below dull purplish green, paler on terminal space, with a series of dark streaks, and numerous scattered black scales. Hind wing below with the purplish-green color almost obliterated by long dark streaks on interspaces terminally and on costa; a central pale streak is irradiated with dark scales.

Expanse: 60 mm.

Habitat.—Espírito Santo, Brazil.

Type.—U.S.N.M. No. 34769.

One paratype.

HALISIDOTA GROTA, new species

Male.—The palpi with a lateral black line; head and thorax pallid purple-drab, with two black points behind head; patagia white. Abdomen above black, underneath white; also the anal hairs white. Fore wing pale vinaceous-fawn with minute black points, slightly larger at end of cell and subterminally on interspaces. Hind wing semihyaline, being paler than fore wing; a smoky dark spot on termen before tornus; also two small black spots at end of costa and faint irrorations at tips of other veins. Wings below similar but less distinct.

Expanse: 51 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34770.

One paratype.

HALISIDOTA NAYAPANA, new species

Female.—Palpi short, black; head and collar isabella color, with darker streaks; thorax pale purplish gray; patagia primuline yellow, with medial, fuscous, vertical line. Abdomen above fuscous-green, with black segmental lines; underneath greenish white, with darker mottling and a lateral fine, partly broken, undulating black line. Fore wing antimony yellow as base color; the veins mostly finely streaked with light cinnamon-drab; the costal edge with numerous black points; a dark streak along vein 5 from base of cell, then broken into spots to termen; terminal half of wing with large greenish-white spots, oval shaped and finely edged with dark lines, all on interspaces, which include small triangular black spots, both postmedially and subterminally; on the underside the base is thickly suffused with brownish drab, the outer half the same as above. Hind wing above black, underneath black, the costa broadly pale yellowish with a medial black spot and dark streaks at apex.

Expanse: 60 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34771.

One paratype.

HALISIDOTA TOLEDANA, new species

Male.—Head, thorax, and patagia pinkish white, the patagia dorsally edged with black; abdomen above with dark-shaded segmental lines, the anal segment white. Fore wing maize yellow, the cilia white; a dark olive-brown streak from base straight to apex touched above by a similar spot at end of cell; fine dark transverse lines antemedially; small subterminal black spots on interspaces, some of the spots semilunular; veins dark, also a fine postmedial line. Hind wing light chalcedony yellow, with slightly darker suffusions; veins slightly darker; a small subterminal dark spot below vein 3. Fore wing below chalcedony yellow, the marking of upper side all faint. Hind wing below, the darker suffusions below costa more intense, otherwise the same.

Expanse: 50 mm.

Habitat.—Rio Sargo, Bolivia.

Type.—U.S.N.M. No. 34772. Dognin collection.

HALISIDOTA ALARICA, new species

Male.—Head, collar, thorax, and patagia pinard yellow, with fine dark vertical lines, more heavily marked on metathorax; abdomen above maize yellow, with faint darker segmental lines. Fore wing with apex rounded baryta yellow, with brownish transverse lines on costa from base to within cell; from above inner margin at base an olive-brown streak expands and extends to termen near apex, postmedially between veins 3 and 5 dentate lines, somewhat lunular subterminal, the veins terminally dark, the cilia whitish. Hind wing naphthaline yellow, with faintly darker suffusions. Fore wing below with faint traces of the postmedial markings. Hind wing below as above.

Expanse: 50 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34773.

HALISIDOTA MARTONA, new series

Male.—This species is closely allied to *H. matona*. The abdomen is grayish avellaneous, with a broken, black, wavy, lateral line. Fore wing with the black point and faint markings very similar to the other species. Hind wing with the inner half suffused with dark ocher-yellow and two short fuscous streaks below end of costa, the underside with two narrow ovate spots on costa terminally.

Expanse: 56 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34774.

Male and two female paratypes.

HALISIDOTA CALVONA, new species

Male.—Head and collar light brown mixed with darker hairs; patagia dull white concealing the dark hairs on thorax; abdomen above isabella color with dark segmental lines, anal hairs and underside white. Fore wing above greenish white, with light yellowish-olive broad streaks along costa and from cell to apex; a shorter streak above termen; some scattered black scales and some black points postmedially and subterminally and also at tips of veins. Hind wing above dull greenish white with a broad serpentine green fascia along termen varying in length and intensity. Wings below whitish green, with some black points on fore wing, the fascia on hind wing reduced to short streak or broad and darker along the outer margin.

Expanse: 45–50 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34775.

Four paratypes.

HALISIDOTA LOMARA, new species

Male.—Palpi black; head and collar pinkish gray; thorax with black hairs; patagia grayish white; abdomen above black with paler segmental lines; a white spot on anal segment, underneath grayish white. Fore wing pale greenish gray, with scattered black points, the postmedial spots on interspaces, distinct, black; some black scales on termen. Hind wing more distinctly greenish, with darker suffusions on inner margin, the costa narrowly white; some dark green terminal spots toward costa. Wings below pale greenish, with scattered black scales, the postmedial and terminal black spots of fore wing prominent. The species is allied to *H. nella* in shape, but the spots on the underside are quite different, consisting of small clusters of black spots, instead of the distinct black spots of *H. lomara*.

Expanse: 48 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34776.

HALISIDOTA MISONA, new species

Male.—Head and patagia naples yellow; collar dark olive-brown; thorax apparently black concealed by patagia; abdomen above dark olive-brown, the terminal segments with paler segmental lines and a few hairs at tip of anal segment, a lateral broken black line, ventrally with pale segmental lines. Fore wing mostly sulphine yellow, the base, costa, and small spots toward apex amber-yellow; black points along

costa, on basal third, postmedial and subterminal interspaces, a black streak within the cell, and a black point at end of cell. Hind wing partly sulphine yellow, the interspaces with darker suffusions and short dark streaks terminally at apex, the inner margin and cilia white. Wings below light buff, the fore wing with traces of spots on apical third, the cilia white, the hind wing with a medial dark point below costa and the terminal streaks conspicuous.

Expanse: 45 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34777.

HALISIDOTA MANADA, new species

Female.—Head and collar deep olive-buff; thorax and patagia pale pinkish buff; abdomen dorsally olive-ocher with fine whitish segmental lines, underneath white. Fore wing reed yellow with minute dark points; a black point at end of cell, faintly continued to apex; small dark spots on interspaces postmedially and subterminal, toward apex forming dark streaks. Hind wing reed yellow. Fore wing below as above, the marking more faintly indicated; hind wing below as above.

Expanse: 55 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34778.

HALISIDOTA SIEGRUNA, new species

Female.—Head and collar deep olive-buff; patagia white; abdomen above honey yellow becoming paler on terminal half with fine pale segmental lines. Fore wing reed yellow, with dark irrorations along veins forming a dark streak below cell and postmedially above inner margin; a black point at end of cell and a dark streak at apex, black points subterminally on interspaces and dark tips to veins. Hind wing reed yellow with dull shading except on termen; a dark spot terminally near inner margin. Fore wing below with the markings more pronounced, the subterminal spots like broken ovals. Hind wing below as above.

Expanse: 60 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34779.

Possibly a variation of *H. manada*.

HALISIDOTA DOMARA, new species

Female.—Head and collar chamois; thorax covered by colonial-buff patagia; abdomen olive-yellow with darker transverse lines underneath. Wings marguerite yellow; fore wing with a line of black spots antemedially on costa; some minute dark irrorations; a black

spot at end of cell; minute black spots subterminally on interspaces and black points at tips of veins. Hind wing with some black spots on termen subterminally and on tips of veins. Fore wing below with the markings faintly shown. Hind wing below faintly suffused with a slightly smoky shade, the costa broadly white.

Expanse: 55 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34780.

HALISIDOTA SUAVINA, new species

Female.—Head and collar warm buff crossed by a vertical black line; thorax with grayish and black hairs; patagia pale grayish vinaceous; abdomen light grayish vinaceous with dark segmental lines. Fore wing pale grayish vinaceous, the veins finely chamois; a darker shade at end of cell; small dark points on all interspaces. Hind wing white with very faint darker suffusions except on termen. Wings below as on upper side except the veins, which are of the ground color.

Expanse: 45 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34781.

HALISIDOTA POTAMIA, new species

Male.—Head and collar pale lobelia; thorax with a vertical black line; patagia white with dorsal black hairs; abdomen above dorsally with pinkish hairs at base, otherwise light purple-drab with darker segmental lines, underneath pinkish white with dorsal black spots on a black segmental line. Fore wing pinkish; a black streak along inner margin; the cell black antemedially, diverging at middle of cell with a small black spot at vein 5; the veins on outer half pinkish, the interspaces irrorated with black scales and small black spots subterminally, the cellular black line more definite on the right wing. Hind wing benzo brown. Fore wing below paler than above with black line on inner margin, and a few black irrorations on outer half. Hind wing below dark lavender, the costal margin pinkish white.

Expanse: 63 mm.

Habitat.—Mesopotamia, Dept. Antioquia, Colombia, 5,000 feet.

Type.—U.S.N.M. No. 34782.

HALISIDOTA SPORINA, new species

Male.—Head pinkish gray, a similar color edging a black spot on collar; thorax with long black hairs; patagia pale grayish vinaceous with a few dark scales. Abdomen above mottled brown and vinaceous, underneath dull vinaceous with a wavy black lateral line. Fore wing grayish vinaceous, black points along costa antemedially and medially also a few in cell; a wavy dark brown shade from cell to

apex; the veins on terminal half pale brown, subterminal semicircular spots on interspaces; black points terminally. Hind wing the inner margin broadly pyrite yellow, the costa and termen white. Wings below pinard yellow, the fore wing markings indistinctly apparent on terminal third, the hind wing with a dark subterminal spot near anal angle.

Expanse: 44 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34783.

HALISIDOTA CHESTERIA, new species

Male.—Head and collar vinaceous-buff; thorax purplish brown, the patagia pinkish white; abdomen above with clay color and dark transverse lines, the anal hairs white underneath with narrow dark and broad whitish transverse lines. Fore wing pale congo pink, the veins finely darker; small dark spots on basal half of costa and a few dark irrorations, subterminal semicircular dark reddish spots on interspaces; terminal black spots at tips of veins, at end of cell a very conspicuous round black spot; between veins 6 and 7 the subterminal spots form streaks. Hind wing light buff, with slightly darker suffusions except on margins; a short dark streak on termen below costa. Wings underneath naphthaline yellow, the fore wing with markings reduced and fainter, the hind wing with a few dark scales at end of costa.

Expanse: 42 mm.

Habitat.—Santa Catharina, Brazil.

Type.—U.S.N.M. No. 34784.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington: 1941

No. 3103

DINOTOCRINUS, A NEW FOSSIL INADUNATE CRENOID GENUS

By EDWIN KIRK

THE new crinoid genus here described comes from the lower Chester group of Alabama and the Chester of Illinois (Mississippian). It is distinctive but has a limited known geographic and stratigraphic range. One new species and two described species are referred to the genus.

DINOTOCRINUS, new genus

Genotype.—*Dinotocrinus compactus*, new species.

Generic diagnosis.—

- Crown. Compact, subcylindrical, expanding slightly to about one-half its height, then contracting slightly. Ratio of dorsal cup to height of crown about 1:10.
- Dorsal cup. Cyathiform, with sharply truncated base.
- IBB. Small, fused into a flat, pentagonal plate entirely contained within the basal depression.
- BB. Large, forming the base of the cup as seen in side view.
- RR. Wider than high, large. Facet full width of R, linear. Suture slightly gaping.
- IBr. One in each ray. Variable in height; those in r and l post and ant RR tending to be higher than those in r and l ant RR. Upper sloping faces of IAx long.

Arms. Relatively short and stout. Typically one isotomous division above the main dichotom. In one half-ray in one specimen there is an additional division giving an endotomous structure. One assumes that in later, at present unknown, species of the genus endotomy would obtain. The first division above the dichotom is high up, with an average of about 10 IIBr. An occasional half-ray as in the 1 post R of the holotype has the division at a considerably higher point. The Br are high and have slightly sloping faces. The pinnules are relatively long and stout.

Post IR. RA large, entering fairly deeply between post and r post BB. X smaller, extending well above radial facet. X meets post B on a narrow face. RT slightly smaller than anal X, the greater part of the plate extending above the radial facet. Contact of RT and r post B narrow.

Ventral sac. Short, slender, reflexed.

Column. Circular in section, with prominent nodals and internodal series.

Characteristic species of the genus.—

DINOTOCRINUS COMPACTUS, new species

"Ste. Genevieve," about 7 miles south of Huntsville, Ala.

For description, see below.

DINOTOCRINUS ROEMERI (Troost), new combination

Cyathocrinites roemerii TROOST, 1850, p. 61, *nom. nud.*

Cyathocrinites roemerii TROOST, 1909, p. 86, pl. 6, fig. 11.

"Carboniferous limestone—vicinity of Huntsville, Alabama." (Gasper?)

Cited as synonym of *Scaphiocrinus huntsvillae* Worthen by Wood, 1909, p. 86.

DINOTOCRINUS SALTERI (Worthen), new combination

Poteriocrinus salteri WORTHEN, 1882, p. 21.

Poteriocrinus salteri WORTHEN, 1883, p. 291, pl. 29, fig. 18.

Scaphiocrinus salteri WACHSMUTH and SPRINGER, 1886, p. 236 (160).

"Chester; Chester, Illinois."

Geologic and geographic distribution.—The genus as yet is known only in the lower Chester of Alabama and the Chester of Illinois.

Relationships.—In its general habit *Dinotocrinus* resembles the European genus *Woodocrinus*. Many American species have hitherto been referred to *Woodocrinus* with little justification. The cyathi-

form cup and depressed base of *Dinotocrinus* at once separate the genus from *Woodocrinus* with its turbinate cup and prominent IBB. *Dinotocrinus* resembles very young *Zeacrinus*, and, although one would not place them in the same family, the probability is that they are nearly related. Although many of the crinoid genera associated with *Dinotocrinus* carry on upward into the prolific crinoid faunas of the higher Chester, neither *Dinotocrinus* nor any form clearly derivative from it has been found so far. *Dinotocrinus* seems nearly related to *Dasciocrinus* and may be ancestral to it.

Remarks.—I have referred *Poteriocrinus salteri* Worthen to *Dinotocrinus*. The figure is poor, and I have not examined the type, but there is a great similarity to young *Dinotocrinus*, and there does not seem to be any other Chester genus to which it is referable. *Agassizocrinus hemisphericus* Worthen may fall here, but well-preserved crowns from the Chester of Illinois with similar dorsal cups do not agree in arm structure. *Cyathocrinites roemeri* Troost is a *Dinotocrinus*. Troost's type is a young specimen in a very poor state of preservation. Wood (1909, p. 86) lists Troost's species as a synonym of *Scaphiocrinus hantsvillae* Worthen. This cannot be. If Worthen's figure can be relied on, his species is quite distinct and probably referable to *Dasciocrinus*. The horizon of *Dinotocrinus roemeri* is uncertain. Judged from the lithology of the matrix, it seems probable that the specimen was collected from the Gasper. This is the horizon from which most of the crinoids were taken in the early days.

DINOTOCRINUS COMPACTUS, new species

PLATE 63

Of this species there are some 35 crowns available for study, the net result of collections made during many field seasons by Carl Rominger, Charles Wachsmuth and his wife, and me. The specimens range in size from 13 to 40 millimeters in height.

With the arms erect the crown is subcylindrical, with closely appressed rami, except in the posterior inter-ray. The crown is notable in the relative shortness and stoutness of the rami.

The dorsal cup is cyathiform, with a sharply truncate base. The ratio of height to breadth is approximately 3:8. The IBB are closely united in a pentagonal plate that extends well beyond the column and lies entirely within the basal depression. The basals are large, tumid, and form the base of the cup as seen in lateral view. The radials are wider than high. The articulating suture is linear and slightly gaping, extending the full width of the radial. The radianal is large, resting below on the post and r post BB and penetrating fairly deeply between them. The contact with the pos-

terior basal is considerably longer than that with the right posterior basal. The radianal extends upward to approximately two-thirds the height of the r post R. Anal X rests on the r post B on a narrow face and contacts r post B on a considerably longer face. Anal X extends upward above the plane of the radial facet. The right tube plate is large, resting on RA on a relatively narrow face, and extends upward above the plane of the radial facet by about two-thirds its height.

There is a single primibrach in each radius. The primaxials are heavy, with long axillary faces. The IAx in the r and l post and ant RR are considerably higher than those in the other rays. The IAx are constricted medially, and there are inconclusive indications that each is composed of two fused primibrachs.

The rami are relatively short and stout. Typically there is but a single isotomous division above the main dichotom. In one specimen in one half-ray there is an additional bifurcation resulting in an endotomous structure. The divisions in the half-rays take place in medium-sized specimens at about the eighth or tenth secundibrach, but exceptionally it may come considerably higher. Owing to the height of the brachials the division is high up, nearly at one-half the height of the arms. The brachials are high, nearly quadrangular in the distal portion of the ramus and with slightly sloping faces proximad. Pinnules are borne on alternate sides by successive brachials. The secundaxils are tumid to subspinous, giving the rami a decided flexure at this level. The terminal rami are divergent at their inception, which, combined with the outward flexure of the IIAx, makes this portion of the arms quite prominent. These characters become more pronounced with age. The pinnules are long and stout.

The ventral sac has been seen in but one individual, a young specimen here figured. The sac is short and slender, apparently having a height of but about one-half that of the arms. It is reflexed, but how far down on the anterior side the reflexed portion extends is not known.

The column is circular in section, with well-defined nodals and internodal series.

Type.—The holotype, S 4401a, and paratypes, S 4401b-f, are in the Springer collection in the United States National Museum.

Horizon and locality.—The species has been found only in the formation known as Ste. Genevieve in the Alabama geological reports. All specimens were collected approximately 7 miles south of Huntsville, Ala.

Relationships.—*Dinotocrinus compactus* may readily be distinguished from *D. roemer*i (Troost) from the same region. In specimens of comparable size the arms of *D. roemer*i are relatively stouter

and shorter, and the second bifurcation is higher up. The dorsal cup of *D. roemeri* is badly preserved, and comparisons are of little value.

Ontogeny.—The dorsal cup in very young specimens is more rotund and the plates less tumid than in the older specimens. The IAx in young individuals, as is usual, are proportionately longer and more slender than in older specimens. The same is also true of the succeeding brachials. In young specimens the number of IIBr is six as a rule, though one half-ray seen had but four. The number of IIBr increases with age, the usual number in the largest specimens being 10 or 12.

There is a slight divergence of the rami resting on the IIX in young and medium-sized specimens. With increasing age the axillary faces of the IIAx tend to form a more acute angle. This throws the bases of the terminal rami still farther apart.

LITERATURE CITED

TROOST, GERARD.

1850. A list of the fossil crinoids of Tennessee. Proc. Amer. Assoc. Adv. Sci. 1849, pp. 59-64.

1909. A critical summary of Troost's unpublished manuscript on the crinoids of Tennessee. (Edited by Elvira Wood.) U. S. Nat. Mus. Bull. 64, xi+150 pp., 15 pls.

WACHSMUTH, CHARLES, and SPRINGER, FRANK.

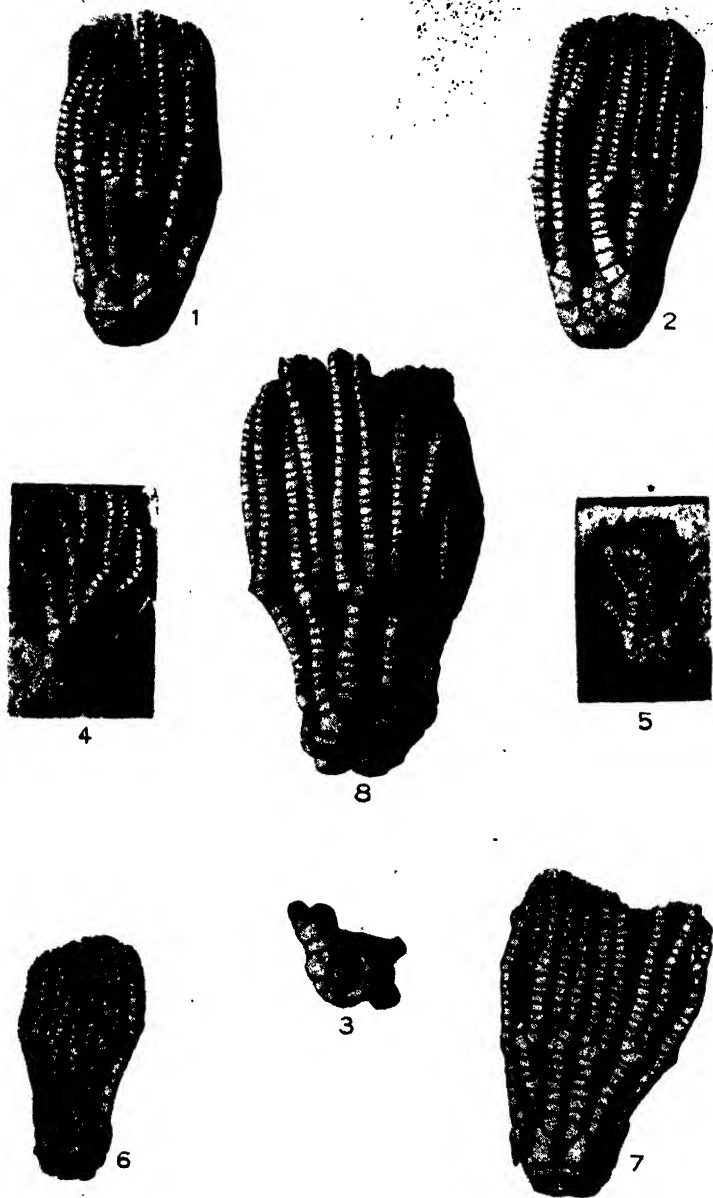
1886. Revision of the Palaeocrinoiden: Pt. 3, sect. 2. Proc. Acad. Nat. Sci. Philadelphia, 1886, pp. 139-334. (One unnumbered page inserted after p. 302. One inserted page, "Note to Page 255," which appeared in two different forms. Index to pts. 1-3, pp. 303-334.)

WOOD, ELVIRA. (See Troost, 1909.)

WORTHEN, AMOS HENRY.

1882. Descriptions of fifty-four new species of crinoids from the lower Carboniferous limestones and Coal Measures of Illinois and Iowa. Illinois State Mus. Nat. Hist. Bull. 1, art. 1, pp. 3-38.

1883. Description of fossil invertebrates. Illinois Geol. Surv., vol. 7, pt. 2, sect. 2, pp. 265-338, pls. 27-30.



DINOTOCRINUS COMPACTUS. NEW GENUS AND SPECIES

1-3, Anterior, posterior, and basal views of holotype; 4, probably anterior view of young specimen; 5, posterior view of young specimen, showing ventral sac; 6, anterior view of somewhat larger specimen; 7, medium-sized specimen, showing the ant R to the left; 8, specimen of maximum known size, l post R to the right. All figures $\times 1\frac{1}{2}$.



issued by the
SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1941

No. 3104

A SUPPOSED JELLYFISH FROM THE PRE-CAMBRIAN OF THE GRAND CANYON

By R. S. BASSLER

THE search for fossils in pre-Cambrian rocks has always intrigued the geologist, but the comparatively few discoveries have led to almost as many controversial discussions, some of which are now classic in the literature. Pre-Cambrian fossils so interested the late Dr. Charles D. Walcott that he spent many months of his long, busy life in the discovery and interpretation of their remains. Shortly after his death, Mrs. Mary Vaux Walcott, in memory of her husband, established the Charles Doolittle Walcott medal and honorarium, to encourage further researches upon the paleontology of the earliest sedimentary rocks. The outcrops of the little metamorphosed pre-Cambrian strata in which fossils might be expected are usually in more or less inaccessible regions where collecting presents difficulties other than those of finding specimens. Besides, the few fossils found have led to the belief that these strata instead of being marine might have originated upon the ancient continents.

The paucity of marine fossils in pre-Cambrian rocks makes it impossible to solve the problem of their origin. However, there must have been valid reasons for their apparent absence, since life was necessary at this time to account for the great abundance in the succeeding Cambrian rocks. Prof. William Keith Brooks believed that these oldest organisms lived at the surface of the ocean and lacked hard parts because the weight of the skeleton would have been detrimental to them. Dr. Walcott thought the pre-Cambrian strata were fresh-water deposits in lakes of low calcium content located considerable distances inland. Prof. T. C. Chamberlin suggested that all organisms originated on the land and did not reach the sea until early Paleozoic times. Daly's theory was that the pre-

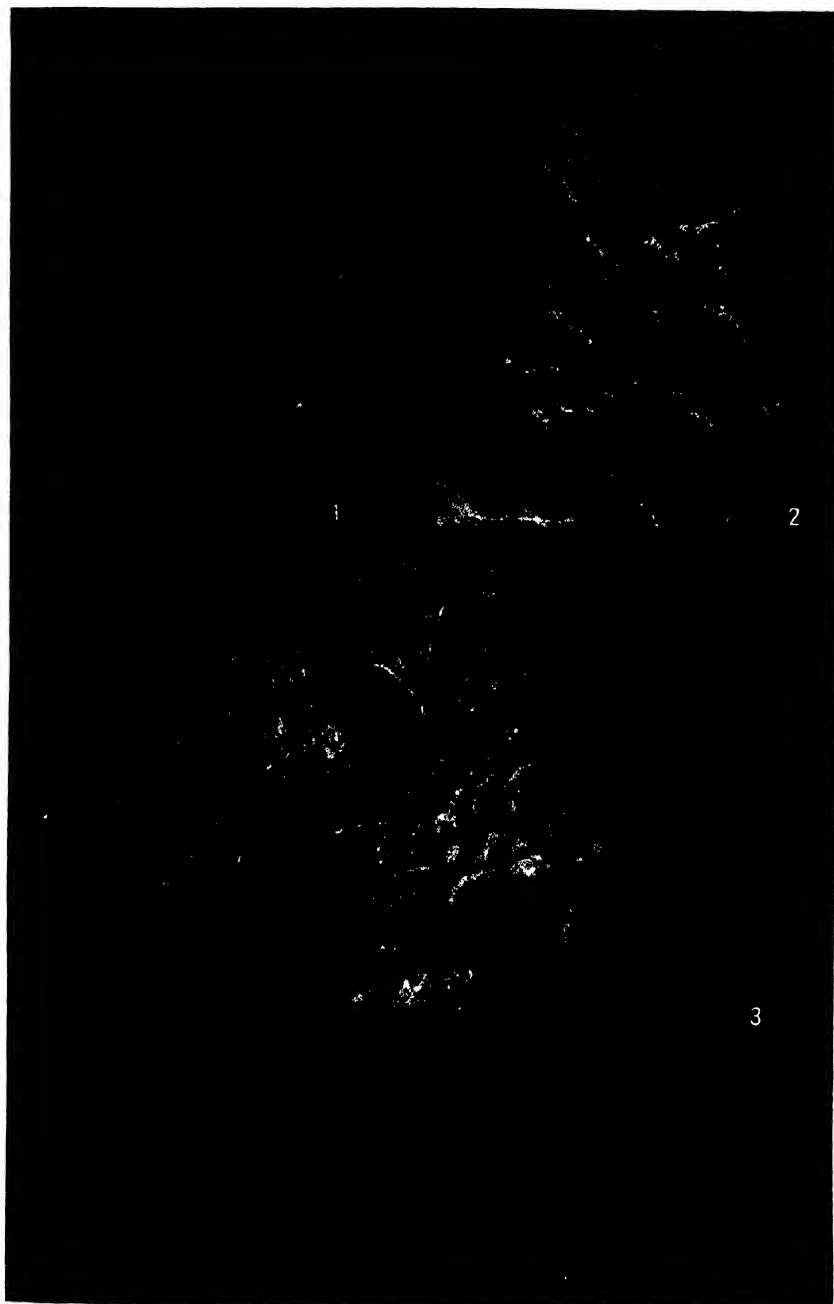
Cambrian marine organisms lacked calcareous parts because of insufficient calcium in the waters of that time. However, the great bodies of pre-Cambrian limestone and marbles would seem to preclude this idea. Prof. A. C. Lane considered the waters of the pre-Cambrian oceans to be so acid that calcareous skeletons could not be formed. Prof. Percy E. Raymond followed Brooks' theory with the modification that skeletons appeared when a sluggish mode of existence was adopted. And, lastly, it is quite possible that the metamorphism of the rocks since pre-Cambrian times would account for most of the apparent absence, but then many of the strata are scarcely metamorphosed at all. Professor Raymond has elaborated these various theories in his address as retiring president of the Paleontological Society in 1934.¹

Although every object remotely resembling a fossil from the oldest strata of the Grand Canyon regions has been carefully collected and studied, so few have been accepted as real fossils that their number is almost negligible. These few have been classified as algae, sponges, and worm tracks, but there are students who deny that all these can be proved to be of organic origin. The discovery, therefore, of an imprint apparently of a jellyfish in the red sandstone of the Nankoweap middle group of the Grand Canyon series above the lavas forming the top of the Unkar lower group, by C. E. Van Gundy in 1935, and brought to the attention of scientists by Prof. Norman E. A. Hinds at the December 1937 annual meeting of the Carnegie Institution of Washington, is of great interest provided the specimen is correctly classified. Mr. Van Gundy² in 1936 published an abstract of the stratigraphy of the Nankoweap group and mentioned the occurrence of this medusa as suggesting a marine environment for the beds containing it. The subject was discussed by Professor Hinds in 1938,³ and he noted that this jellyfish is the only authenticated animal fossil discovered in the Grand Canyon pre-Cambrian, all others strongly suggesting the inorganic markings found throughout this series. Professor Hinds further stated the specimen had been identified as probably a jellyfish by the present writer and that a detailed description of it would be published later. Then, Dr. J. C. Merriam, president of the Carnegie Institution, under whose leadership the Grand Canyon researches were undertaken, presented the specimen to the United States National Museum on the promise that it would be described. Since making this promise, the writer has become less certain of his first opinion as to the animal nature of the specimen, which was based upon its resemblance to *Brooksella* and

¹ Bull. Geol. Soc. Amer., vol. 46, No. 3, pp. 375-392. 1935.

² Proc. Geol. Soc. Amer., 1936, p. 304.

³ Science, new ser., vol. 88, No. 2278, Aug. 26, 1938.



BROOKSELLA CANYONENSIS. NEW SPECIES.

1-3, Views of the type specimen, with light from various angles (fig. 2 coated with ammonium chloride); 4, edge of sandstone bed showing at least five overlapping layers, upon four of which the specimen rests. Natural size.

other medusalike Cambrian fossils and to the hardened, dried-up jellyfishes along the seashores today, but nevertheless he believes the facts favor this interpretation. In an issue of the Carnegie News Service, Dr. Hinds gave a popular account of the subject, entitled "An Early Chapter of Earth History".⁴ Since then he has made special efforts to discover more material in the Grand Canyon section without any results. As it is very probable that there will be little opportunity for further search because of the expense involved in collecting in this very inaccessible area, he believes there should be no further delay in naming the form so that it can be quoted in definite terms.

The lobation of the single specimen is so similar to that in a jellyfish that it seems hardly possible it can be an accidental resemblance produced by inorganic markings. It is realized, of course, that a series of specimens should be discovered so that their variations or possible proof that they are simply markings can be verified. This specimen and photographs of it have been shown to various Washington and visiting paleontologists, who have varied in opinion from one pronouncing it undoubtedly a medusa to the opposite that it is positively inorganic. Dr. G. Stiasny, of the Rijksmuseum at Leiden, Holland, the leading student of medusae, to whom the photographs were shown, reports that while the fossil looks in outline somewhat like a medusa, closer examination shows that it resembles neither the sennaeostomatean or rhizostomatean medusae, the two great groups of these animals. He says the furrows do not represent radial canals, the pouches are not stomach pouches, and the two polygons in the center are certainly unknown. In addition, Dr. Stiasny believes that the jellyfishes described from the earliest rocks do not in most cases belong to this group of animals at all.

The illustrations of this supposed fossil have been prepared to show its structure as clearly as possible under varying aspects. The imprint is upon a slab of thin-bedded, fine-grained sandstone marked upon its upper surface by cross-bedding or overlapping ripple marks. Portions of these have been stained reddish brown with iron as is the imprint itself. Viewing the edge of the slab (pl. 64, fig. 4), one may see the minute sand grains piled up into ripplelike overlapping layers with the imprint crossing several of them. Exactly similar conditions may be noted today on the Atlantic shores, especially along Chesapeake Bay, where the jellyfishes when left stranded dry into slightly shriveled bodies but still retain their general shape, before being covered by the sand layers of succeeding waves. No detailed description of the lobes is advisable, since each observer might have a different interpretation, but it is evident that this specimen is a more

⁴ Bull. Carnegie Inst., Washington, vol. 4, No. 23, Mar. 13, 1938.

or less regularly outlined object with the individual lobate areas radiating from a center unfortunately somewhat crushed. It is also true that there is considerable resemblance to the abundant supposed jellyfish from the Middle Cambrian of the Coosa Valley of Alabama, named *Brooksella alternata* by Walcott. This *Brooksella* occurs in limestone from which the uncrushed fossil forms have been freed by silicification and weathering. Polished sections of it show a series of canals, radiating from the center, but, as noted before, doubt has been thrown upon the identification of this fossil as a jellyfish. It may be an algal form, in which case the Grand Canyon specimen possibly had a similar origin and therefore would not have the same geological significance as if it had been a jellyfish. At any rate, it seems not unreasonable to apply a name to this imprint, fossil or inorganic.

Genus BROOKSELLA Walcott

BROOKSELLA CANYONENSIS, new species

PLATE 64

This new specific name is suggested for a supposed jellyfish represented by a single individual about 7 centimeters in its major diameter, impressed and compressed upon a slab of fine-grained sandstone and resting upon the edges of the laminations of several successive ripple marks. From the central portion of the disk, which is considerably crushed, the specimen continues into 8 to 10 somewhat uniformly arranged lobes of fairly equal size, all stained red with iron and more or less distinctly marked out by the lighter-colored sandstone. The lobes all show crushing along the midline; and the edge of the disk suggests a somewhat pentagonal form slightly elevated above the surrounding sandstone upon which it is impressed.

The above description may contain some wishful thinking, but the writer believes, although the specimen does have considerable superficial resemblance to *Brooksella*, that the best proof for it as an organism lies in the fact that this lobed structure is impressed upon a series of ripple marks which elsewhere on the slab appear as dark colored, rather evenly arranged layers. In other words, other parts of the slab with exactly the same arrangement of sand layers should show similar markings if the specimen were inorganic.

Occurrence.—Proterozoic (Algonkian) sandstones of the Nankoweap middle group above the lavas marking the top of the Unkar lower division of the Grand Canyon series, near the bottom of the Grand Canyon of the Colorado River, Ariz.

Holotype.—U.S.N.M. No. 99438.



SMITHSONIAN INSTITUTION
U. S. NATIONAL MUSEUM

Vol. 89

Washington : 1941

NOTES ON BIRDS OF THE GUATEMALAN HIGHLANDS

By ALEXANDER WETMORE

MANY years ago the Smithsonian Institution was fortunate in receiving small collections of birds from the elevated plateau of western Guatemala from Dr. C. H. Van Patten and from Osbert Salvin, with a few scattered contributions from other sources. These came at a time when Central American birds were just beginning to be well known, and the material was highly valuable to the studies of Baird, Ridgway, and other ornithologists of the day. The representation of species, however, was far from complete, and many of the specimens did not have the detailed data required in modern studies. Therefore I welcomed an opportunity that came in the latter part of 1936 to visit Guatemala, both for the interesting studies that this offered and for the additions in needed material to the collections of the United States National Museum. My work covered the period from the latter part of October to the first days of December and, except for a few observations around Puerto Barrios, was confined to the highlands above an elevation of 3,200 feet. The region examined included the slopes of the volcanoes of Agua, Acatenango, and Fuego, the vicinity of the beautiful lake of Atitlán, and the mountains above Tecpam, including one trip to the highland region of Desconsuelo in the Department of Totonicapám. Attention was focused principally on the indigenous forms of the plateau and mountain area, and on the movements of the abundant migrant birds from North America.

ITINERARY

In the early morning of October 25, 1936, I reached Puerto Barrios, Guatemala, on the S. S. *Metapan*. Through the assistance of Mr. Austin, of the United Fruit Co., and the courtesy of the Guatemalan officials my field equipment was passed through customs without delay, and an hour later I was aboard the train for Guatemala City, where I arrived that evening. Through Gerald A. Drew, Chargé d'Affaires ad interim in the temporary absence of the American Minister, I received from General Anzueto, Director General de la Policía Nacional, a letter to the police officials of the country as well as a complimentary driver's permit, and from the Secretaría de Guerra an arms permit to cover my collecting guns. Delphino Sánchez Latour, of the Ministerio de Relaciones Exteriores, arranged for me a general letter of recommendation from the Minister of Finance. E. J. La Garde, of the United Fruit Co., was most courteous in various matters.

In Guatemala City I rented a car and on the evening of October 27 drove to Antigua across a low range of mountains, a journey that required an hour. Here my old friend Dr. Wilson Popenoe, director of agricultural experiments for the United Fruit Co., had placed at my disposal his home, the picturesque and comfortable Casa Colonial, built originally about 1635, partly destroyed in an earthquake near the close of the eighteenth century, and then restored recently by Dr. and Mrs. Popenoe in a faithful presentation of its original form and furnished delightfully in the Spanish style of the early seventeenth century. With this as my home and faithful María, caretaker for the house, to prepare my meals and care for other comforts, I began my work in the field in Guatemala. Coronel Carlos Cipriani, Jefe Politico of the Departamento de Sacatepéquez, to whom I had letters from Mr. Drew and Mr. Latour, was most cordial, and on October 29 I began my actual work in the field.

For two weeks I collected steadily in this interesting region. Dueñas and Canderas where I worked especially are classic localities through the early investigations of Osbert Salvin. The level country adjacent to Antigua was mainly in cultivation that extended up over the slopes of the mountains, but in ravines or on steep slopes above the fields were thickets and groves of trees. On the northward face of Volcán de Chimaltenango above Canderas I had easy access to a tract of heavy rain forest. Birds were scarce in this woodland, and I had better collecting lower down. On October 31 I drove to Santa María de Jesús and climbed through little fields to 8,000 feet on Volcán de Agua. Toward Chimaltenango I found a region of milpas diversified with thickets, scattered woodland, and pastures, while on the southern slopes of Volcán de Fuego below Alotenango

were great barrancas cut by the floods of the rainy season in beds of volcanic ash. In this latter desolate region burrowing owls, black phoebes, and occasional swallows were the main inhabitants. In the barren barrancas I walked in blazing sun with little cover. Still farther down beyond Alotenango at 3,200 feet, below the barrio of Las Lajas, there were coffee plantations beside a great barranca that harbored many interesting birds. The road continued on to Escuintla.

On November 9 I drove through Chimaltenango and Patzum to Panajachel, where I located in the Hotel Tsanyuyú on the shore of Lake Atitlán. The blue waters of this lake fill a deep valley and are bounded by slopes covered with milpas of maize, in places where the land sloped so abruptly that cultivation seemed impossible. The cones of Volcán San Pedro and Volcán Tolimán rose directly from the lake shore with others towering just beyond. I had come here especially to search for the large grebe *Podilymbus gigas* and devoted attention for the first 2 days to the lake itself, hunting from a launch powered with a decrepit engine whose occasional breakdowns gave me time to enjoy the beauties of the lake and its mountain background. I traveled along the northern and eastern shores where, except for the fill made by the Río Panajachel at the foot of its valley, the shores were steep and there were no beaches. Often the rock descended abruptly directly to the water, while in other places small shrubs and low trees lined the slopes. Occasionally a coarse-stemmed reed grew out for a short distance into the water, and rarely there were scattered plants of a round-stemmed *Scirpus*. In bays of shallower water toward the east and toward the west this *Scirpus* was more abundant.

The narrow valley at Panajachel had little coffee plantations toward the lake and dense thickets on the slopes elsewhere, the valley floor being devoted to milpas (cornfields and truck gardens) and pastures, with low second growth where the flood plain of the stream was too stony for cultivation. The abrupt slopes on either side were accessible from steep trails that the Indians climbed as readily as goats.

On November 16 I crossed to Tecpam, which lies at an elevation of a little over 7,000 feet, near the site of ancient Iximché, the Indian capital of the region at the time of the Spanish Conquest. From here, with chains on the rear wheels of the auto, I climbed slowly through the mud of a steep and winding mountain road, which in the fog and steady rain seemed to rise without end, until I arrived at the Sierra Santa Elena, the estate of Axel Pira, whose house was at an elevation of nearly 9,500 feet. Here I was received with the most friendly hospitality, and here I found one of the most inter-

esting regions for my work. On the surrounding slopes and above extended a great forest of cypress and pine, the former with trunks often 6 to 8 feet in diameter and summits that towered from 125 to 200 feet in the air. With their wide knowledge of the local avifauna my host and his son, Axel, Jr., gave every assistance in my work. While birds were less abundant than at lower elevations, they were of especial interest because of their peculiar type. In these mountains, in addition to species unknown in the north, there range representative races of a number of kinds of birds that are typical of the Rocky Mountains in the western United States, here at or near their southern limit. These include among others a hairy woodpecker, a golden-crowned kinglet, a crested jay, and a brown creeper. A species of junco was one of the most abundant birds. With these were the brilliant trogons, the strange woodhewers that climbed on the tree trunks like woodpeckers, brilliant mountain warblers, beautifully colored hummingbirds, and other species that one normally associates with the Central American avifauna.

Farther down the mountain at the Finca Chichivac, also owned by Señor Pira, were forests of oak and other deciduous trees mixed with pines, and here there was less of the almost continual fog and rain of the higher elevations. One evening at Sierra Santa Elena the fog cleared and the night air was sharp and cold. The following morning the ground was white with a heavy frost and the sky was clear. In the sunshine, most welcome after obscure days of fog, I climbed to a lookout point at 10,000 feet elevation, where I had a marvelous view over the mountains to the waters of Lake Atitlán, while as my eye followed the line of the horizon, I counted the cones of 12 volcanoes ranged in a great semicircle in the background.

On November 24, another day of brilliant sunshine, we drove to the elevated region of Desconsuelo, where we stopped about 14 kilometers from the town of Totonicapám. The elevation ranged from 10,000 to 10,600 feet, with open country on the high, rolling ridges, grown with grass or covered with low, dense thickets, and scattered trees. Forests of great pines came to 10,200 feet, among them occasional gnarled patriarchs fully 10 feet through. Little valleys where there were small streams of clear water often contained marshy cienagas. The sun was warm and bright, and the grass green, and the dark forests made a pleasing background. Birds were abundant, and I made an excellent collection.

On the return we visited the great rock of María Tecum, sacred to the Indians, standing on a mountain shoulder with a sheer drop of several hundred feet on its open face. From the summit there is a wonderful view across broad reaches of mountain and valley.

On November 28 I left the friendly atmosphere of Sierra Santa Elena with regret that I might not remain longer and that noon arrived in Antigua. In the 2 days that remained to me I worked the tropical section at 3,200 feet below Alotenago, again studying and collecting many interesting birds.

The morning of December 1 I devoted to packing, and in the afternoon I moved to Guatemala City, and the following day made official visits that closed my work. December 3 I continued by train to Puerto Barrios. On the following morning I crossed the bay in a dugout canoe with two men for a few hours collecting in the swampy thickets of a small island. That night, with all my specimens prepared, I was on board the S. S. *Platano* for the return trip to New York.

NOTES ON NORTH AMERICAN MIGRANTS

For the North American migrant birds that travel the land route beyond Mexico, Guatemala forms the lower section of a funnel, for here the mass separating the Atlantic and the Pacific Oceans is suddenly narrowed, and there is consequently a concentration of birds that at times is truly remarkable. More interesting still, because of this narrow land area, birds with summer homes in the eastern and in the western parts of the North American Continent mingled in mixed flocks. On certain days migrants predominated over the local residents, and it soon became evident that the native kinds ordinarily were secretive and that small birds seen flitting actively and openly among the branches were almost certain to be northern migrants. For identification and record I took examples of all, but to avoid shooting migrant birds needlessly it was necessary to examine carefully, often with binoculars, every bird that was seen to determine whether it was desired.

It was fascinating to me always to find species associated that in the North are separated by hundreds or even thousands of miles. As an example, black-throated green warblers of the East and Townsend's warblers of the West ranged in the same scattered bands, accompanied perhaps by such companions as black-billed cuckoos and rose-breasted grosbeaks of eastern range and western tanagers from the Rocky Mountains. Though familiar for years with all these in their northern homes, their intermingling here in Guatemala brought me always a sensation of surprise, as in my mind I associated them always with the far separated ranges in which I knew them in the distant North.

Many of these migrants were obviously in their wintering ground, while others as obviously were hurrying farther south. For the continuation of their journey there is no apparent reason except the

urge to go to a definite region without regard to equal facilities for food and safety that might be encountered on the way. These latter travelers often seemed to pass in waves as for a day the woodlands would be filled with them and then they would disappear. By the middle of November this southern movement lessened in amount and in fact seemed to end. The migrants encountered later seemed to be settled in their winter homes.

Family COLYMBIDAE

COLYMBUS NIGRICOLLIS CALIFORNICUS (Heermann)

Podiceps Californicus HEERMANN, Proc. Acad. Nat. Sci. Philadelphia, vol. 7, 1854 (Apr. 12, 1855), p. 179 (California).

On November 9 I saw two on Lake Atitlán, near Panajachel. Other grebes seen were probably this species but were not certainly identified

COLYMBUS DOMINICUS BRACHYPTERUS Chapman: Mexican Grebe

Colymbus dominicus brachypterus CHAPMAN, Bull. Amer. Mus. Nat. Hist., vol. 12, Dec. 23, 1899, p. 256 (Lomita Ranch, Lower Rio Grande Valley, Texas).

On Lake Atitlán these small grebes are common along the shore so that I noted them daily from November 9 to 15. One that I collected on November 12 was prepared as a skeleton. One or two pairs lived in a little bay near the hotel and were obviously mating at this season. Frequently I heard from them a low chattering note.

PODILYMBUS GIGAS Griscom

Podilymbus gigas GRISCOM, Amer. Mus. Nov., No. 379, 1929, p. 5 (Panajachel, Lake Atitlán, Guatemala).

One of the reasons for my visit to Lake Atitlán was to search for this grebe, known only from this body of water. And on the afternoon of my arrival on November 9 I was fortunate in securing a fine pair. At the hotel below Panajachel I arranged for a small launch with an engineer who was certain that he knew this bird. We cruised along the steep slopes of the east side of the lake, watching carefully, until finally in a little bay in front of a small village I had a glimpse of a thick head and large bill rising in the water 45 yards away and fired quickly to be rewarded by the sight of a wing in the air as my grebe, shot through the neck, turned over in the water. Although a pied-billed grebe in form and color the bird, a male, was truly huge, its size leaving no possible doubt as to its identity. On the return I saw various small grebes and finally had another quick shot at a large one, which I secured. This was a female, decidedly smaller than the male but still larger than the widely distributed *Podilymbus podiceps*.

On November 10 I went out again in the forenoon and by noon had two more pairs, making six in all, with which I was content. Four were prepared as skins and two as skeletons. These large grebes seemed rather solitary and ranged alone. At a distance they were easily separated from the other species found here by much greater size, which marked them at a glance. When approached they dived and on appearing again showed only the head and the upper back. Sometimes they swam submerged into the open lake, where they were hidden by the waves and sometimes they retreated to the scanty cover of the rushes along the shore. While very quick it was my impression that they were slower than the common pied-billed grebe; they were certainly much slower in submerging than their small companions, *Colymbus dominicus brachypterus*. The breeding season was near in the birds taken, though one female (prepared as a skeleton) was molting the wing feathers. They were not heard to call.

At the hotel one came regularly into a tiny bay where I could watch it easily. At a distance the bill appears completely white, and the body dark except on the posterior portion. When the feathers were puffed out to catch the sun the bird appeared very large indeed. Griscom's estimate of 100 pairs for the lake in 1930 seems reasonably accurate for the condition that I found in 1936. On November 9 I actually saw 8 birds and on November 10 between 12 and 15. My observations covered only a small part of the lake, and I did not go out on the water except on these two days.

Measurements of the four grebes preserved as skins are as follows: 2 males, wing 131.4, 139.8, culmen from base 26.0, 27.5, depth of bill at base 18.0, 18.5, tarsus 48.5, 50, middle toe with claw, 70, 70 mm.; 2 females, wing 122.8, 126, culmen from base 22.3, 22.4, depth of bill at base 15, 15, tarsus 41.4, 42.1, middle toe with claw 61.3, 63 mm.

The larger bulk of these birds as compared with the largest individuals of *Podilymbus podiceps* has already been noticed, the difference being strongly marked in the skeleton. The larger skull of *gigas* also has stronger muscle attachments and processes, the pterygoid and the postorbital process especially being heavier. The humerus in *gigas* is only slightly longer and very little heavier than in the largest *podiceps*, and the crista superior, while larger, is very little longer, indicating a relatively weaker wing. The distal end of the humerus has the trochlea swung at a somewhat different angle in *gigas*.

There is no question that *Podilymbus gigas* is a distinct species.

Family PHAËTHONTIDAE

PHAËTHON LEPTURUS CATESBYI Brandt: Yellow-billed Tropic-bird

Phaëthon catesbyi BRANDT, Bull. Sci. Acad. Imp. St. Pétersbourg, vol. 4, 1888, col. 98 (Bermuda).

On December 5, as our ship came out of the inner bay at Puerto Barrios, three of these tropic-birds were observed diving from the wing into the water. Griscom does not include this species in his list of the birds at Guatemala.

Family FREGATIDAE

FREGATA MAGNIFICENS ROTHSCILDII Mathews

Fregata minor rothschildi MATHEWS, Birds of Australla, vol. 4, 1915, p. 280, (Aruba, Dutch West Indies).

A number were flying over the harbor at Puerto Barrios on December 4.

Family ARDEIDAE

ARDEA HERODIAS Linnaeus: Great Blue Heron

Ardea Herodias LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 143 (Hudson Bay).

One was recorded on Lake Atitlán November 12. While it may have been the typical form, as recorded by Griscom, there is no certainty of this as the bird was seen only at a distance.

BUTORIDES VIRESCENS (Linnaeus)

Ardea virescens LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 144 (South Carolina).

Green herons were seen occasionally along the shore near the hotel at Lake Atitlán from November 10 to 12.

Family CATHARTIDAE

CORAGYPS ATRATUS (Bechstein)

Vultur atratus BECHSTEIN, Allg. Uebers., Vögel, vol. 1, Anhang, 1793, p. 655 (Florida).

While most abundant in the tropical lowlands from Puerto Barrios inland, where I saw them October 25 and December 3 and 4, zopilotes were common over the plateau region. At Antigua the birds were fairly numerous and came to rest in evening on the walls

or trees around the azotea of the Casa Popenoe, but they disappeared at dusk. One day at noon, after the heavy air blanket of early morning had been warmed and the sun suddenly appeared black vultures flapped heavily over the houses until on the wing and then began to soar steadily upward. Several dozen remained high in the air during the entire afternoon. On clear days they were constantly overhead. I noted them in the town of Santa María de Jesús on October 31 and found them common at Dueñas, where they ranged on clear days to an elevation of 7,200 feet on Volcán de Acatenango. At Ciudad Vieja three remained daily on guard over a dead dog by the roadside from November 3 to 5, and one still stood by to strip what it could from the bones and hide when I passed on November 8. Zopilotes were seen in numbers at Panajachel, soaring high overhead on clear days. Here on November 12 I found half a dozen in a coffee finca where there were large trees loaded with ripening avocados. From time to time these fruits were loosened by the wind and fell to the ground to burst with a loud pop, when one of the vultures would descend to feed on the soft pulp. I saw another group of vultures watching for falling avocados on the following day, and I was told that this was regular custom with them. It is the first time I ever observed them taking vegetable food.

At Chichivac, above Tecpam, numbers were noted on November 26 soaring overhead. The birds were seen regularly here in the sky, but were reported not to nest at this elevation. The highest seen were four observed in the sky above Sierra Santa Elena on November 23. The birds were said to appear here from the lowlands only during their aerial evolutions.

Zopilotes in many localities were very tame and merely moved aside to let me pass and showed the same disregard for automobiles. At the Zoological Garden in Aurora Park in Guatemala City a dozen fearlessly invaded the cage of a sleeping European brown bear in search of food.

CATHARTES AURA AURA Linnaeus

Vultur Aura LINNAEUS, *Systema naturae*, ed. 10, vol. 1, 1758, p. 86 (Veracruz, Mexico).

The turkey vulture, often called the *viuda*, was widely distributed over the plateau region, though outnumbered by the black vulture at least two to one. I saw them regularly soaring over the slopes of Volcán de Acatenango near Canderas and above Dueñas on the lower slopes of Volcán de Agua above Santa María de Jesús, and near the base of Volcán de Fuego below Alotenango. At Panajachel they were seen daily near the lake, and above Tecpam I recorded

them at Chichivac on November 26. November 24 I saw one over the open ridges of Desconsuelo at 10,200 feet. December 3 they were fairly common along the railroad between Guatemala City and Puerto Barrios.

No indication of migration was noted so that the birds seen are supposed to be the resident form.

Family ACCIPITRIDAE

ACCIPITER STRIATUS VELOX (Wilson)

Falco velox WILSON, American ornithology, vol. 5, 1812, p. 116, pl. 45, fig. 1 (Philadelphia, Pa.).

Near Dueñas I saw one on November 3 at close range in a dry wash. At Panajachel several were noted in densely grown ravines, and on November 12 I shot an adult male. This bird had used the perch where it was secured for some time, as the ground beneath was covered with its droppings.

BUTEO JAMAICENSIS (Gmelin)

Falco jamaicensis GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 266 (Jamaica).

At 6,500 feet on the slopes of Volcán de Acatenango, above Dueñas, on November 4 I saw a red-tailed hawk with dark head and throat and white under parts pass overhead. On November 24, at 10,500 feet at Desconsuelo, a beautiful dark bird with a red tail came to rest in the top of a tall pine but circled away screaming shrilly before I came within gun range. It is probable that the second bird was *B. j. calurus*, while the first may have been of this race or may have been *B. j. costaricensis*.

BUTEO NITIDA MICRUS Miller and Griscom

Buteo nitida micrus MILLER and GRISCOM, Amer. Mus. Nov., No. 25, Dec. 7, 1921, p. 4 (4 miles northeast of Chinandega, Nicaragua).

On November 30 in the open woods of a coffee finca at 3,200 feet near Las Lajas on the Pacific slope below Alotenango I heard low cries from a large bird hidden in the leaves of a tree top. As I walked toward it suddenly it flew out and swooped at another that I had not seen, and both circled above the trees. Against the light they appeared in silhouette without color, and I was surprised when I shot one at long range to pick up one of these light-colored hawks. The general appearance was that of *Buteo magnirostris*, with rather heavy body and short tail.

The specimen, a female with the wing measuring 345 mm., has the gray bars of the under surface rather broad and dark in color, agreeing with the diagnosis of the subspecies *micrus*. The second light tail bar is quite definite, the character being one in which there is much variation. I agree with van Rossem¹ that there are no characters for maintaining *Asturina* as a genus apart from *Buteo*.

CIRCUS CYANEUS HUDSONIUS (Linnaeus): Marsh Hawk

Falco hudsonius LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 128 (Hudson Bay).

On December 3 one circled over open fields near Zacapa.

Family PANDIONIDAE

PANDION HALIAETUS CAROLINENSIS (Gmelin): Osprey

Falco Haliaëtus γ carolinensis GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 263 (South Carolina).

One was circling over the harbor at Puerto Barrios with a fish in its talons on December 2. I could see the head markings clearly, making sure that it was the race *carolinensis*.

Family FALCONIDAE

POLYBORUS CHERIWAY AUDUBONII Cassin

Polyborus Audubonii CASSIN, Proc. Acad. Nat. Sci. Philadelphia, vol. 17, 1865, p. 2 (Florida).

On December 3 I saw one near Zacapa.

FALCO SPARVERIUS SPARVERIUS Linnaeus: Eastern Sparrow Hawk

Falco sparverius LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 90 (South Carolina).

The three specimens taken are migrant birds from the north, as shown by their size. These include a male from San Antonio de Aguas Calientes, 2 miles southwest of Antigua, October 29 (wing 184 mm.), a female from Dueñas, November 8 (wing 192 mm.), and a male from 9,500 feet elevation at Sierra Santa Elena, November 21 (wing 183 mm.). The birds were common through the plateau country and were seen on many occasions. On November 2 I found a number along the Barranca Honda, where they rested on projecting points on the high earthen cliffs. There were a few at Sierra Santa Elena in openings in the forest, and on November 24 I saw several above 10,000 feet elevation in the open parks at Desconsuelo.

¹ Bull. Mus. Comp. Zool., vol. 77, 1934, p. 429.

Identification of these specimens and some others obtained since in southeastern Mexico has led to careful examination of a large series of sparrow hawks from North America with the result that I have been forced to the conclusion that all north of the ranges of *Falco s. parulus* of the extreme southeastern United States and *Falco s. peninsularis* of the lower half of Baja California must be called *Falco s. sparverius*.

Laid out in series it may appear at first glance that birds from the eastern part of North America are darker than those from the west, a distinction that has been recognized for years by calling these western birds *Falco s. phalaena*. The darker color seems most evident in females, less so in males. On critical examination, however, it appears that the difference in color does not hold for enough individuals to allow a subspecific designation, as many eastern birds are pale and many western ones dark. There is no appreciable difference in dimensions between birds from the two areas.

In making comparisons examination has been made in turn of breeding series, of a large number of specimens in fresh plumage taken in fall, winter, and spring, and finally of a considerable number of immature individuals recently from the nest. These latter, though averaging decidedly darker, show the same variations as the adults without regard to geographic locality. Birds in fresh plumage are ordinarily darker than those taken toward the middle of the breeding season, and I believe that the lighter color of many individuals is due to actual fading, particularly of the reddish brown that is so prominent in the plumage of these falcons. Naturally this fading is more pronounced in sections of small rainfall where the light is more intense, and less so in more humid areas where the light is more diffused. The exposed perches frequented by these hawks favor this process and through it the birds would naturally become paler quickly in the sun of the arid areas of the southwest.

There is a distinct tendency toward dichromatism in this race in that many are erythristic, i. e., the reddish brown is intensified, and in the male suffuses the light band at the tip of the tail, which in others is white. Such a condition is well known in some of the tropical races. The chestnut crown cap is large, small, or absent without regard to locality.

Family PHASIANIDAE

DENDRORTYX LEUCOPHRYS NICARAGUAE Miller and Griscom

Dendrortyx leucophrys nicaraguae MILLER and GRISCOM, Amer. Mus. Nov., No. 183, July 18, 1925, p. 1 (Jalapa, 4,000 feet elevation, Nicaragua).

During my stay at the hospitable Sierra Santa Elena there was much talk of the elusive *guachoque*, as these long-tailed, forest-

haunting quail are called, and I spent considerable time in working through rather dense rain forest in wet and mud with one or two glimpses of reddish-brown birds of fair size, or their excited calls as they rose before the dogs behind cover, as the only result. Finally, on November 27, three or four flushed from dense, low growth, and one that chanced to pass within sight among the branches was secured. Later another flew from dense second growth, and I shot it, to lose it down the slope, where we found it only after long search. The wings of this handsome bird do not make the startling roar of northern quail and grouse. The crops of the two specimens were filled with small drupes.

One of the birds taken had the skin so torn that I could preserve it only as a skeleton. The other is probably a male, though the sex organs were destroyed by shot.

These birds are rare in collections. In fact, so few have been available that definite appraisal of the characters and ranges of the forms that have been described is not now practicable, though I have seen the specimens that are found in the Academy of Natural Sciences of Philadelphia, the American Museum of Natural History, the Field Museum, and the H. B. Conover collection, in addition to those in the National Museum. In brief, the single specimen from Sierra Santa Elena agrees most closely with the form *nicaraguae*, the dark, slaty ear coverts and reduced amount of chestnut streaking indicating this alliance. The bird is, however, more grayish, less brown on the lower back and rump, and is uniform in that area without mottling. It is distinct from true *leucophrys* of the eastern highlands of Guatemala, that bird being much more heavily and extensively streaked with chestnut. This identification represents an extension of range of *nicaraguae* into west-central Guatemala, it having been reported previously in this direction only as far as the mountains of El Salvador.

In my opinion *hypospodius* of Costa Rica is not a distinct species of *Dendrortyx* but merely a geographic race of *D. leucophrys*, marked by the reduction of the chestnut streaking, and its restriction to the foreneck and sides on the ventral surface, the lessened amount of this streaking above, and general duller dark color.

Family CHARADRIIDAE

OXYECHUS VOCIFERUS VOCIFERUS (Linnaeus): Killdeer

Charadrius vociferus LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 150 (South Carolina).

A killdeer, called in Guatemala *collarejo*, was taken November 24 at 10,200 feet elevation at Desconsuelo from a flock of a dozen rang-

ing in open meadows. The birds were said to be of regular occurrence there.

Family SCOLOPACIDAE

CAPELLA DELICATA (Ord): Wilson's Snipe

Scolopax delicata ORD, in reprint of Wilson's American ornithology, vol. 9, 1825, p. ccxviii (Pennsylvania).

In a marshy meadow at 9,500 feet near Sierra Santa Elena one flushed November 17. On November 20 one was taken here from eight or ten that were seen. Another was observed on November 23, and on the following day at Desconsuelo one rose from a little cienaga at 10,200 feet.

ACTITIS MACULARIA (Linnaeus): Spotted Sandpiper

Tringa macularia LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 246 (Pennsylvania).

Several were seen on November 11 along the Río Panajachel above the town, and on the following day along the shore of Lake Atitlán. On December 4 they were common along the beaches at Puerto Cortez.

Family LARIDAE

LARUS ATRICILLA Linnaeus: Laughing Gull

Larus atricilla LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 136 (Bahamas).

Many were seen in the harbor at Puerto Barrios, December 4.

Family COLUMBIDAE

COLUMBA FASCIATA FASCIATA Say: Band-tailed Pigeon

Columba fasciata SAY, in Long's Expedition to the Rocky Mountains, vol. 2, 1823, p. 10 (Plum Creek, near Castle Rock, Douglas County, Colo.).

One was seen at 9,500 feet near Sierra Santa Elena on November 21. Above Los Encuentros a dozen circled over open hills on November 24.

ZENAUDURA MACROURA MARGINELLA (Woodhouse): Western Mourning Dove

Ectopistes marginellus WOODHOUS., Proc. Acad. Nat. Sci. Philadelphia, vol. 6, 1852, p. 104 (Cross Timbers, north fork of the Canadian River, Oklahoma).

Two females collected, one at 4,800 feet elevation at the west base of Volcán de Agua near Alotenango on November 5, and one at 5,700 feet altitude at La Alameda near Chimaltenango November 7, are both typical examples of the western race *marginella*. Whether the eastern form figures among other sight records is uncertain.

Around Alotenango I noted mourning doves on November 2 along the barren Barranca Honda toward the base of Volcán de Fuego, and the following day saw many flying in early morning over old corn-fields. Near Panajachel from November 11 to 15 they were found in brush-grown pastures or were seen flying along the lake shore at dusk. On November 24 one flushed on an open ridge at 10,500 feet elevation at Desconsuelo. On the morning of November 29 there was much shooting at mourning doves. And on December 2 in the principal market in Guatemala City I saw a woman offering doves for sale in bundles of four, asking 6 cents a bird, or 60 cents a dozen, which probably meant that they might be purchased for 3 to 5 cents each. She had about 100 freshly killed birds. Those that I examined closely were the western race.

ZENAIDA ASIATICA ASIATICA (Linnaeus): Eastern White-winged Dove

Columba asiatica LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 163 (Jamaica).

Seen at Zacapa on December 3 and on a low island opposite Puerto Barrios on December 4.

COLUMBIGALLINA PASSERINA PALLESCENS (Baird): Mexican Ground Dove

Chamaepelia passerina ? var. *pallescens* BAIRD, Proc. Acad. Nat. Sci. Philadelphia, 1859 (Jan. 12, 1860), p. 305 (Cape St. Lucas, Baja California).

Near Antigua and Dueñas these birds were distributed through the fields and along the barrancas in small numbers, usually in pairs or singly. Several were seen at Panajachel.

Griscorn has noted² that these doves from Guatemala are intermediate between *pallescens* and *neglecta* but nearer the former. A male that I shot near Dueñas on November 8 is identical with skins of *neglecta* from Costa Rica. A female taken at Panajachel on November 15 is similar to *pallescens*. An immature just from the nest was collected with the female last mentioned.

Family PSITTACIDAE

ARATINGA CANICULARIS CANICULARIS (Linnaeus)

Psittacus canicularis LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 98 (northwestern Costa Rica.)

At Las Lajas, at an elevation of 3,500 feet on the east base of the Volcán de Fuego, I heard the chatter of parakeets in tall trees above a coffee plantation and climbed laboriously up a steep slope to secure one of these birds. A dozen or so flew about in pairs in swift, direct

² Bull. Amer. Mus. Nat. Hist., vol. 44, 1932, pp. 113-114.

flight. In the tops of dead trees they were conspicuous but when among leaves I had difficulty in seeing them. Others were observed there on November 5.

Bangs and Peters³ have shown that two forms are represented in this species. After examination of a good series in the National Museum it appears to me that the character separating them is found in the width of the orange-buff frontal band, this being narrow and restricted in birds from western Mexico *Aratinga c. eburnirostrum* (Lesson), the color usually not reaching the loreal area. In the typical race *canicularis* the broad frontal band extends back to the anterior line of the eye, or farther, and sometimes comes down over the anterior part of the lores. The color is more restricted in young birds as has been noted by van Rossem.⁴ The shade of green in these birds is variable and offers no differences correlated with geographic range.

Several from Acapulco, southern Guerrero, in the National Museum are typical *canicularis*, so that the dividing line between this and *eburnirostrum* comes farther north in Guerrero, if we accept the statement of Bangs and Peters that the northern bird ranges from Guerrero to Sinaloa.

ARATINGA HOLOCHLORA STRENUA (Ridgway)

Conurus holochlorus strenuus RIDGWAY, Proc. Biol. Soc. Washington, vol. 28, May 27, 1915, p. 106 (Ometepe, Nicaragua).

At the Finca Chichivac (elevation 8,600 feet), above Tecpam, these parakeets came in flocks to feed in the fields of maize. Carlos Pira gave me one taken there on November 14, and two more on November 20. These last had the crops filled with corn. On November 24 at Los Arcos a dozen circled high in the air.

After examination of a fair series I agree with van Rossem that this bird is best considered a geographic race of *Aratinga holochlora*, though Bangs and Peters⁵ list both *holochlora* and *strenua* in a collection made by W. W. Brown at Tapanatepec, Oaxaca, in September 1927. I should, however, hold *Aratinga brevipes* of Socorro Island as a distinct species because of the different wing formula (with the tenth primary shorter than the seventh, instead of vice versa as in *holochlora* and its races) and its isolated position. Under this the birds of this group would stand as follows:

Aratinga brevipes (Lawrence).

Aratinga holochlora holochlora (Sclater).

Aratinga holochlora brewsteri Nelson.

Aratinga holochlora strenua (Ridgway).

Aratinga holochlora rubritorques (Sclater).

³ Bull. Mus. Comp. Zool., vol. 68, 1928, pp. 388-389.

⁴ Field Mus. Nat. Hist., zool. ser., vol. 23, 1938, p. 204.

⁵ Bull. Mus. Comp. Zool., vol. 68, 1928, p. 388.

Family CUCULIDAE

COCYZUS ERYTHROPHthalmus (Wilson): Black-billed Cuckoo

Cuculus erythrophthalmus WILSON, American ornithology, vol. 4, 1811, p. 1, pl. 28, fig. 2 (near Philadelphia, Pa.).

A female was shot at 7,800 feet on the slopes of Volcán de Agua above Santa María de Jesús on October 31. The bird was very fat.

PIAYA CAYANA THERMOPHILA Sclater

Piaya thermophila SCLATER, Proc. Zool. Soc. London, 1859 (Feb. 1860), p. 368 (Jalapa, Veracruz).

On November 29 at Las Lajas at 3,200 feet elevation below Alotenango two worked quietly through shade trees over coffee. A female taken had the back feathers very loose. On the following day I watched one for some time in this same coffee plantation. It alighted to rest quietly for a minute or two, then hopped and ran quickly across two or three branches, to stop and move the long tail up and down while it peered about in typical cuckoo fashion. After another run it reached over to take something from a clump of mistletoe. At times it was wholly quiet, but ordinarily the tail was in motion.

The specimen taken has the dark coloration typical of *thermophila* and shows no indication of the lighter shade of *P. c. stirtoni* van Rossem from El Salvador.⁶ After examination of a large series of *thermophila* I have not been able to segregate the form described by Griscom from Panamá as *Piaya cayana incincta*.⁷ The width of the subterminal black tail band on the dorsal surface of the rectrices varies considerably throughout the entire range of *thermophila*, being occasionally even absent on the middle pair of feathers. There is similar variation in the presence or absence of a rufescent mixture on the ventral surface of the tail.

GEOCOCYX VELOX AFFINIS Hartlaub

Geococcyx affinis HARTLAUB, Rev. Zool., vol. 7, 1844, p. 215 (Guatemala).

One was seen near Alotenango, November 5.

CROTOPHAGA SULCIROSTRIS SULCIROSTRIS Swainson

Crotophaga sulcirostris SWAINSON, Phil. Mag., new ser., vol. 1, June 1827, p. 440 (Tableland, Temascaltepec, Mexico).

At Las Lajas below Alotenango at an elevation of 3,500 feet I shot one of these birds from the top of a tall tree in a heavily wooded

⁶ *Piaya cayana stirtoni* van Rossem, Trans. San Diego Soc. Nat. Hist., vol. 6, Sept. 30, 1930, p. 209 (Mount Cacaguatique, Dept. San Miguel, El Salvador).

⁷ *Piaya cayana incincta* Griscom, Bull. Mus. Comp. Zool., vol. 72, Jan. 1932, p. 324 (Permé, Caribbean slope of Darien, eastern Panamá).

barranca and two days later secured another from a little flock in a dense growth of weeds in an old field. Both specimens were in very ragged plumage. To my ear, long familiar with the querulous calls of *Crotophaga ani*, the notes of this bird are quite different and decidedly more musical.

Family TYTONIDAE

TYTO PERLATA GUATEMALAE (Ridgway)

Strix flammea var. *Guatemalae* RIDGWAY, in Baird and Ridgway, Bull. Essex Inst., Dec. 1873, p. 200 (Chinandega, Nicaragua *).

A primary feather, marked by darker color when compared with the barn owl of the United States, was found in the Barranca Honda at the foot of Volcán de Fuego, November 2.

Family STRIGIDAE

SPEOTYTO CUNICULARIA HYPUGAEA (Bonaparte): Western Burrowing Owl

Strix hypugaea BONAPARTE, American ornithology, vol. 1, 1825, p. 72 (plains of the Platte River).

In a barren section of the Barranca Honda at 3,800 feet elevation below Alotenango I saw two on November 2 and shot a female.

Family CAPRIMULGIDAE

CHORDEILES MINOR (Forster)

Caprimulgus minor J. R. FORSTER, A catalogue of the animals of North America, 1771, p. 13 (South Carolina).

On the evening of November 12 several flew over the lake near the Hotel Tsanyuyú.

Family MICROPODIDAE

STREPTOPROCNE ZONARIS MEXICANA Ridgway

Streptoprocne zonaris mexicana RIDGWAY, Proc. Biol. Soc. Washington, vol. 23, Apr. 19, 1910, p. 53 (Río Seco, near Córdoba, Veracruz, Mexico).

On November 13 near Panajachel 15 or 20 coursed with their usual amazing speed over the point of a hill high above the town. The first one that I shot fell far away into the valley and was lost. But I watched there until one came driving directly at me as I stood on the pitch of a very steep slope and killed it 50 yards away, to have it hurtle

* See Baird, Brewer, and Ridgway, History of North American Birds, vol. 3, January 1874, p. 11.

in to fall almost at my feet so great was its momentum. Raúl, my companion, said that they nested on a nearby rock cliff. Others were seen near Alotenango at 3,200 feet on November 29 and 30.

The bird taken, a male, is in partial molt. It has a wing measurement of 207 mm. and the forehead lighter than the crown, the size and the color mentioned being characteristic of the race *mexicana*.

STREPTOPROCNE ZONARIS ALBICINCTA (Cabanis)

Hemiprocne albicincta CABANIS, Journ. für Orn., 1862, p. 165 (Guiana).

On November 29 near Las Lajas below Alotenango flocks of these swifts circled during the entire forenoon, sometimes high overhead, above the soaring zopilotes, and sometimes at a tantalizing distance barely beyond shotgun range. As I returned at noon I saw them lower down above some open fields at 3,900 feet and stopped my auto to watch. The first one that I shot fell far distant and was lost, but the next bird I secured.

This is a female with a wing measurement of 194 mm. The forehead and crown are uniform sooty black, the size and this color indicating clearly the more southern form, here recorded for the first time from Guatemala, where it is probably to be regarded as a migrant wanderer. Van Rossem⁹ has reported a similar bird from Mount Cacaguatique, El Salvador, taken on November 21, 1925.

Family TROCHILIDAE

DORICHA ENICURA (Vieillot)

Trochilus enicurus VIEILLOT, Nouv. Dict. Hist. Nat., vol. 23, Sept. 1818, p. 429 ("Brazil"=Guatemala).

The only specimen taken is an adult male shot near Panajachel November 14 as it fed at flowers in a dense thicket. The flexible tail was often thrown up at a right angle with the back, as was noted also in the long-tailed males of *Tilmatura*, a custom that serves to protect these feathers and allow access to flowers deep-set amid twigs and leaves.

TILMATURA DUPONTII DUPONTII (Lesson)

Ornismya dupontii LESSON, Histoire naturelle des colibris, Suppl., Jan. 1832,¹⁰ p. 100, pl. 1 (Mexico).

At Panajachel on November 12 I found two pairs in a coffee finca near the lake shore and collected a male. The females rested on open twigs while the males poised in the air 5 or 6 inches distant, opening and closing the long fork in the tail, scissors fashion, while the light

⁹ Field Mus. Nat. Hist., zool. ser., vol. 23, 1938, p. 249.

¹⁰ According to C. D. Sherborn, Index animalium, pt. 9, 1926, p. 2052.

glistened from the blue throat. On November 13 I took another at flowers near the village and noted that the tail was raised constantly until it formed a right angle with the line of the back. Another was secured on November 15 from a high perch on a dead twig.

Of the race *xenoura* of Griscom¹¹ I have seen a pair from the type locality. The male shows the narrower chestnut bar on the outer tail feathers that is given as the principal character, when compared with a good series from Guatemala and southern Mexico. Two males in the American Museum of Natural History from Matagalpa and Quilalí, Nicaragua, surprisingly, are like the typical form.

ARCHILOCHUS COLUBRIS (Linnaeus): Ruby-throated Hummingbird

Trochilus Colubris LINNAEUS, *Systema naturae*, ed. 10, vol. 1, 1758, p. 120 (South Carolina).

At Panajachel these northern migrants were common about flowers, so that I secured three males and a female November 11, 12, 13, and 15.

The males had begun to molt so that a spot in the center of the throat has the new metallic red feathers of the adult plumage with one or two scattered new feathers at the side. The rectrices are still those of the juvenal plumage.

SELASPHORUS PLATYCERCUS GUATEMALAE Griscom

Selasphorus platycercus guatemalae GRISCOM, *Proc. New England Zool. Club*, vol. 12, Apr. 3, 1930, p. 2 (Quetzaltenango, Guatemala).

An adult male was taken about flowers at 10,000 feet elevation near the great rock María Tecum, Department of Totonicapám, November 24. This bird has the chestnut markings on axillars, sides, and inner webs of the outer rectrices as well as the small bill that mark this race from typical *S. p. platycercus* of farther north. It measures as follows: Wing 46.9, tail 30, culmen from base 15.7 mm.

There is one other male in the National Museum collected by Salvin, labeled only as from Guatemala.

LAMPORNIS AMETHYSTINUS SALVINI (Ridgway)

Delattria henrica salvini RIDGWAY, *Proc. Biol. Soc. Washington*, vol. 21, Oct. 20, 1908, p. 195 (Calderas, Volcán de Fuego, Guatemala, 7,000–8,000 feet).

Near Sierra Santa Elena these were the most common hummingbirds, six being obtained between November 18 and 23. They were found about little openings in the forest where they worked about flowers with the animation customary in their family, the males

¹¹ *Tilmatura dupontii xenoura* Griscom, *Proc. New England Zool. Club*, vol. 13, Nov. 7, 1932, p. 59 (Cerro Cantorál, District of Achaga, Honduras).

sometimes making a rattling sound with the wings when others came near, apparently a threat. In handling them I noticed that the feathers about the gape were erectile so that they could be arranged in a moustachial form.

LAMPROLAIMA RHAMI RHAMI (Lesson)

Ornismya Rhami LESSON, Rev. Zool., vol. 1, Dec. 1838 (1839), p. 315 (Mexico).

A female taken on November 23 at Sierra Santa Elena with the abundant *Lampornis* was the only one recorded.

COLIBRI THALASSINUS (Swainson)

Trochilus thalassinus SWAINSON, Phil. Mag., new ser., vol. 1, June 1827, p. 441 (Temascáltepec, Mexico).

The two taken include a female from 7,800 feet on the north slope of Volcán de Agua above Santa María de Jesús, shot on October 31, and a male collected at Panajachel on November 15. On the latter date several were seen along the Río Panajachel, resting on open perches on the hillsides or gleaning for insects on leaves and twigs in the thickets. I heard them giving a chirping call.

AMAZILIA CYANOCEPHALA CYANOCEPHALA (Lesson)

Ornismya cyanocephalus LESSON, Histoire naturelle des oiseaux-mouches, 1829, p. 45 ("Brazil").

A male was taken at Panajachel on November 12 as it rested quietly on a shaded twig in a coffee plantation.

While Griscom¹² has listed skins from Panajachel as *A. c. guatemalensis*, this specimen agrees exactly with the typical race of southern Mexico in being distinctly dark green on the back, with the rump and upper tail coverts dull, not showing the light brassy bronze reflections of *guatemalensis*.

HYLOCHARIS LEUCOTIS LEUCOTIS (Vieillot)

Trochilus leucotis VIEILLLOT, Nouv. Dict. Hist. Nat., vol. 23, Sept. 1818, p. 428 (Orizaba, Veracruz¹³).

On October 29, an immature male was taken as it searched among leaves and twigs in a dark, steep-sided, wooded valley at 6,500 feet on the north slope of Volcán de Acatenango, above Dueñas. An adult male was secured on October 31 at 7,800 feet on Volcán de Agua above Santa María de Jesús, and one was seen at Panajachel on November 15. The two taken are the typical form.

¹² Bull. Amer. Mus. Nat. Hist., vol. 64, 1932, p. 203.

¹³ Designated by Griscom, Amer. Mus. Nov., No. 379, 1929, p. 11.

ANTHOSCENUS LONGIROSTRIS PALLIDICEPS (Gould)

Helimaster pallidiceps GOULD, An Introduction to the Trochilidae, 8vo. ed., 1861, p. 139 (Jalapa, Veracruz).

A male in breeding condition was taken in open ground at the border of a coffee plantation at 3,400 feet near Las Lajas below Alotenango on November 5.

Family TROGONIDAE

TROGON COLLARIS PUELLA Gould

Trogon puella GOULD, Proc. Zool. Soc. London, 1845, p. 18 (Escuintla, Guatemala).

In a coffee finca near Las Lajas at 3,200 feet, below Alotenango, these handsome trogons were fairly common. I saw my first one on November 8 when I detected a flash of red among green leaves high above the ground. At this instant the safety lock on my hammerless stuck, and I had to return to my auto for another gun. Fifteen minutes later I came again to find the trogon still resting on the same perch. After a fall from any height trogons of this type always strike amid such a cloud of feathers that I often hesitate to pick them up since it would seem that they must be completely destroyed, but ordinarily the birds, miraculously, appear in good condition—with enough feathers so that many more may be lost during the somewhat tedious process of preparation. On November 29 these trogons were common at this same point, and half a dozen were observed in a tree laden with small fruit. One swooped petulantly at a smaller species that, however, held its ground. I shot another that I prepared for a skeleton. Not only was the skin tender but the flesh also was easily broken as fragments of muscle from ribs and legs came away at a touch from my fingers. The flesh had the same odor—to me highly disagreeable—that is found in anis.

Griscom¹⁴ has described a connecting link between this bird and *T. collaris* of South America.

TROGON MEXICANUS MEXICANUS Swainson

Trogon Mexicanus SWAINSON, Phil. Mag., new ser., vol. 1, June 1827, p. 440 (Temascaltepec, Mexico).

This trogon was fairly common near Sierra Santa Elena from near Chichivac to the dense forests of the higher slopes. The only one taken is a male shot on November 19 by Axel Pira, Jr., in a forested area at 8,600 feet.

¹⁴ Bull. Mus. Comp. Zool., vol. 69, 1929, pp. 162–163.

TROGON VIOLACEUS SALLAEI Bonaparte

Trogon sallaei BONAPARTE, Compt. Rend., vol. 42, 1853, p. 955 (Orizaba, Veracruz, Mexico).

On November 29 and 30 gartered trogons were common about a fig tree in fruit at an elevation of 3,200 feet below Las Lajas. The fig, of medium size, stood in a coffee finca where the growth was fairly open, and it was interesting to see eight or ten of these pretty birds flying in and out to perch among its branches.

Identification of this bird is in accordance with the treatment of Peters¹⁵ and the acceptance of van Rossem's statement^{15a} as to the proper subspecific name.

Family ALCEDINIDAE**MEGACERYLE ALCYON (Linnaeus): Belted Kingfisher**

Alcedo alcyon LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 115 (South Carolina).

Kingfishers were fairly common on the shores of Lake Atitlán on November 9 to 15, and several were seen near Puerto Barrios on December 4. While no specimens were taken it is supposed that they were of the eastern subspecies.

CHLOROCERYLE AMERICANA SEPTENTRIONALIS (Sharpe)

Ceryle septentrionalis SHARPE, Catalogue of the birds in the British Museum, vol. 17, 1892, p. 134 (Teapa, Tabasco, Mexico).

Along the shore of Lake Atitlán these small kingfishers were common. Females were taken in the vicinity of Panajachel on November 10 and 12. When one captured a small fish a grackle swooped at it while the kingfisher chattered in protest and dashed away holding its prey.

The two taken measure as follows: Wing 88.5, 89.8, tail 64.4, 65.0, culmen from base 45.5, 48.3, tarsus 9.8, 10.5 mm. In size these agree with *septentrionalis*, being distinctly larger than *isthmica*. They are also lighter green above and whiter below. There are other specimens from Guatemala in the National Museum that I ascribe to *septentrionalis* from Palín, Cajabón, and Cobán. Griscom¹⁶ considered that Guatemalan birds are intermediate but nearer to *isthmica*, but birds that can properly be called *septentrionalis* range to the south through El Salvador.

¹⁵ Bull. Mus. Comp. Zool., vol. 69, 1929, p. 434.

^{15a} *Ibid.*, vol. 77, 1934, p. 392.

¹⁶ Bull. Amer. Mus. Nat. Hist., vol. 44, 1932, p. 181.

Family MOMOTIDAE

ASPATHA GULARIS (Lafresnaye)

Prionites gularis LAFRESNAYE, Rev. Zool., 1840, p. 130 (Guatemala).

On November 23, near Sierra Santa Elena, Axel Pira killed one of these curious motmots on the wing as it flew through the cypress woods at 8,600 feet elevation. On the evening of November 25 the two of us walked out along open trails to examine some holes that we had found in the hope of securing more of these strange birds. The air was chill and a thin fog lay over the mountainside, but the moon shone through sufficiently to light our way, and we used our flashlights only to avoid stepping into mudholes. Near a little gate we found a perpendicular bank of black earth 8 feet in height. The first few holes in the face of this bank yielded nothing. In the last one examined the beam of the flashlight revealed the bright eye of a little wren peering out from the far end. Leaving this place we went by obscure trails far down the mountainside to another cutbank placed in an opening in the woods. In the first hole, a shallow one, the bright eyes of a rat glistened in the light like smooth black buttons. As she dashed out she brought with her, apparently attached to her nipples, two small young, which we replaced in the tunnel. Several holes were empty, but in the last one a flexible stick brought immediately a scuttling noise and a flash of green feathers, and a motmot came out, followed at once by its companion. In our hands they made no struggle, lying limp as if nearly dead. I was interested to note how the three black marks on the "ears" and the center of the breast stood out and how the light blue of the throat gleamed in the illumination from the flashlight. The two were male and female, and with these we climbed slowly up the mountain paths past the mill to the house.

MOMOTUS LESSONII LESSONII Lesson

Momotus Lessonii LESSON, Rev. Zool., vol. 5, June 1842, p. 174 (Realejo, Nicaragua).

In a coffee finca, at 3,200 feet near Las Lajas, below Alotenango, on November 29 a Lesson's motmot flew to the limb of a tree where my first impression of it was that it was a jay. In dim light the blue of the crown was clearly visible almost as if it were luminescent. This specimen I collected. The following day in this same region I watched another for some time. It was alert, and, though it remained for some time on each perch that it sought, either the tail was in motion or the head was moving as the bird looked about. The

tail was moved up and down, rotated slowly, or swung from side to side like the pendulum of a clock. Sometimes it was held at an angle at one side.

Family RAMPHASTIDAE

AULACORHYNCHUS PRASINUS STENORHABDUS Dickey and van Rossem

Aulacorhynchus prasinus stenorhabdus DICKEY and VAN ROSSEM, Ibis, 1929, pp. 49, 52 (Cerro Los Naranjos, Volcán Santa Ana, Dept. Sonsonate, El Salvador).

On November 3, in a deeply wooded barranca at 3,500 feet near Alotenango, while I was watching a group of birds in a tall treetop, a toucanet came hopping out with twitching tail and was taken. It fell amid grass and leaves directly at my feet where for a minute I could not see it, so closely did its colors match the green of the vegetation. At Sierra Santa Elena Axel Pira, Jr., gave me the skin of one taken there in April 1936.

Family PICIDAE

COLAPTES MEXICANOIDES MEXICANOIDES Lafresnaye

Colaptes mexicanoides LAFRESNAYE, Rev. Zool., 1844, p. 42 (Mexico).

Near Sierra Santa Elena these handsome flickers were common along the borders of woods and trails, ranging from Chichivac at 8,600 feet upward. I saw them also at Canderas and at Patzicia and found them common above 10,200 feet at Desconsuelo. They are typical flickers in general appearance as they fly away with bounding flight, displaying their white rump patches. But most of their high-pitched, chattering, laughing calls are quite different from the notes of the northern species, and only occasionally did my ear catch a sound from them that indicated their flicker relationship. They were found often in pairs. Three were taken at Sierra Santa Elena on November 17 and 18, and two more at Desconsuelo on November 24. One of the latter was prepared as a skeleton.

The four skins agree in dark coloration with specimens from Chiapas though the bills average a little shorter. In two males this measurement is 38.2 and 40 mm., and in two females 36 and 37.6 mm.

CEOPHLOEUS LINEATUS SIMILIS (Lesson)

Picus similis LESSON, Oeuvres complètes de Buffon, vol. 20, 1847, p. 204 (San Carlos, El Salvador).

Two specimens were obtained at an elevation of 3,200 feet near Las Lajas, below Alotenango, a female on November 8 and a male

on November 30. Both birds were working quietly through tall trees in a coffee plantation.

CENTURUS AURIFRONS SANTACRUZI Bonaparte

Centurus Santa Cruzei BONAPARTE, Proc. Zool. Soc. London, 1837 (June 14, 1838), p. 116 (Santa Cruz de Quiché,¹⁷ Guatemala).

This species was fairly common in the areas collected. I found a number in a coffee plantation at 3,200 feet near Las Lajas below Alotenango, and shot a male here on November 3. A female was taken November 4 in a coffee plantation near Dueñas, and I saw several in open country near Canderas the same day. As they flew away with bounding flight the white rump was prominent. Near Panajachel they were found regularly, and one was taken on November 11.

BALANOSPHYRA FORMICIVORA LINEATA Dickey and van Rossem

Balanosphyra formicivora lineata DICKEY and VAN ROSSEM, Proc. Biol. Soc. Washington, vol. 40, Jan. 8, 1927, p. 1 (Mount Cacaguatique, Dept. San Miguel, El Salvador).

On October 31 I found two in tall dead trees in a milpa near Santa María de Jesús and secured a female. The insistent call of this bird was heard near Chimaltenango on November 7, and on November 26 near Chichivac at 8,600 feet above Tecpam several were seen among pines and oaks, and a male was taken.

These two, with a fair series from elsewhere in Guatemala, substantiate Griscom's allocation of the bird of that country to *lineata*. Two that I have seen from Chiapas are somewhat intermediate but are nearer *B. f. formicivora*.

PICULUS RUBIGINOSUS MAXIMUS Griscom

Piculus rubiginosus maximus GRISCOM, Amer. Mus. Nov., No. 379, Oct. 17, 1929, p. 11 (Chanquejelve, Huehuetenango, Guatemala).

Near Panajachel a male was taken on November 15 as it rested amid leaves in the top of a tree standing in a small grove.

While I have followed Griscom in identifying this bird as the race *maximus*, I feel that systematic understanding of the species *rubiginosus* is at present unsatisfactory. In Mexico and Central America these birds seem subject to much individual variation, and I am inclined to believe that too many races may have been proposed.

¹⁷ Designated by Griscom, Bull. Amer. Mus. Nat. Hist., vol. 64, 1932, p. 226.

SPHYRAPICUS VARIUS VARIUS (Linnaeus): Yellow-bellied Sapsucker

Picus varius LINNAEUS, *Systema naturae*, ed. 12, vol. 1, 1766, p. 176 (South Carolina).

At Sierra Santa Elena on November 20 I shot a female in a dense stand of deciduous trees adjacent to a pasture at 9,500 feet. Another female was taken at 10,000 feet near María Tecum on November 24.

DRYOBATES VILLOSUS SANCTORUM Nelson

Dryobates sanctorum NELSON, Auk, Jan. 1897, p. 50 (Todos Santos, Guatemala).

At Sierra Santa Elena this woodpecker was so common that I secured 4 males and 1 female between November 17 and 23. To one accustomed to the clear white markings of the hairy woodpeckers of the North, the dull-brown under parts of these Guatemalan birds was of never-ceasing interest. In some this brown color was found also on the back, but in others the dorsal markings were nearly white. I was inclined to believe that the brown was intensified by staining from the wet, moss-grown trunks over which the birds climbed. I found them in mixed pine and deciduous forest where they worked in typical hairy woodpecker fashion. They were silent, except once when I heard a chattering call from one, suggestive of *Dryobates* but differing from any of the hairy woodpeckers with which I am familiar.

Family DENDROCOLAPTIDAE**LEPIDOCOLAPTES AFFINIS AFFINIS (Lafresnaye)**

Dendrocolaptes affinis LAFRESNAYE, Rev. Zool., vol. 2, Apr. 1839, p. 100 (Mexico).

At Sierra Santa Elena, Axel Pira, Jr., shot one on November 17 at 9,400 feet as it moved along a tree trunk, our attention being called to it by its chattering, laughing call. I saw another there on November 27 and on November 26 shot one in mixed oak and pine woods at 8,600 feet near Chichivac.

LEPIDOCOLAPTES SOULEYETHI COMPRESSUS (Cabanis)

Thripobrotus compressus CABANIS, Journ. für Orn., 1861, p. 243 (Costa Rica).

Near Las Lajas at 3,200 feet elevation below Alotenango I found these birds in a coffee plantation on November 8, 29, and 30 and collected a female on the first date mentioned.

This specimen, with others in the National Museum, corroborates the statement of Brodkorb¹⁸ that birds from the Pacific slope of Guatemala are to be referred to *compressus* rather than to *insignis* as they agree with a long series of skins from Costa Rica and Nicaragua

¹⁸ Occ. Pap. Mus. Zool. Univ. Michigan, No. 369, Apr. 11, 1938, p. 3.

in having the streakings of dorsal and ventral surface definitely narrowed.

Family COTINGIDAE

TITYRA SEMIFASCIATA PERSONATA Jardine and Selby

Tityra personata JARDINE and SELBY, Illustrations of ornithology, vol. 1, pt. 2, June 1827, [p. 63], pl. 24 (Reál del Monte, Hidalgo, Mexico).

These cotingas were found in a coffee plantation at Las Lajas below Alotenango at 3,200 feet elevation on November 8 (specimen), 29, and 30. They are heavy-bodied birds that fly through the treetops with bounding flight to seek high perches where they rest quietly or move about in a leisurely manner. They are easily told by the light body color and the dark markings about the head.

Family PIPRIDAE

CHIROXIPHIA LINEARIS LINEARIS (Bonaparte)

Pipra linearis BONAPARTE, Proc. Zool. Soc. London, 1837 (June 14, 1838), p. 113 (Mexico).

On November 30, on my last day afield near Las Lajas below Alotenango, as I followed an overgrown road through dense, low brush in which stood scattered taller trees, I heard mellow, whistled calls from some bird that remained hidden in the dense cover. While watching I collected a bent-billed flycatcher, and after forcing a way into the thicket to get it, with some difficulty because of thorns and creepers, I continued farther to a spot that was a little more open. Here I began to whistle an imitation of the unknown notes. Answer was immediate, and in a few minutes I had glimpses of a little bird that appeared entirely black, jumping from perch to perch 3 to 5 feet above the ground. Presently opportunity for a shot offered, and after five minutes work I had the bird in hand. My astonishment was great to pick up a male of this handsome manakin as I had had no glimpse of its light blue-black and bright red crown. Its eight or nine companions were not alarmed by shooting and continued their whistling so that presently I secured another.

The feet were bright orange, claws black, iris dark red, and bill black.

In short tail the two taken agree with the typical form of Mexico as restricted by Bangs and Peters.¹⁹

¹⁹ Bull. Mus. Comp. Zool., vol. 68, 1928, p. 307.

Family TYRANNIDAE

TYRANNUS VERTICALIS Say: Arkansas Kingbird

Tyrannus verticalis SAY, in Long's Expedition to the Rocky Mountains, vol. 2, 1823, p. 60 (near La Junta, Colo.).

This migrant from the north is represented by specimens taken in open country near Dueñas (5,000 feet) and at 3,200 feet near Las Lajas, below Alotenango, both on November 29. The latter was secured from a little flock feeding at a wild fig tree in a coffee finca.

TYRANNUS VOCIFERANS Swainson: Cassin's Kingbird

Tyrannus vociferans SWAINSON, Quart. Journ. Sci., vol. 20, 1826, p. 273 (Temascaltepec, Mexico).

Near Chimaltenango on November 7, on an upland at 5,700 feet, where the lanes through the milpas were bordered with pine and cypress, these birds were common. They called occasionally, usually remaining in the tops of the trees, though now and then coming down to perch on the dead stalks of standing corn. A male was taken.

PITANGUS SULPHURATUS GUATEMALENSIS (Lafresnaye)

Saurophagus Guatemalensis LAFRESNAYE, Rev. Mag. Zool., 1852, p. 462 (Guatemala).

One was noted near Puerto Barrios on December 4.

MEGARYNCHUS PITANGUA MEXICANUS (Lafresnaye)

Scaphorhynchus mexicanus LAFRESNAYE, Rev. Mag. Zool., 1851, p. 473 (Mexico).

At 3,200 feet elevation below Alotenango I saw these birds on several occasions and finally, on November 30, collected a pair. They rested usually amid leafy branches in the shade trees of a coffee finca and at times seemed rather wild. In general appearance they suggest *Pitangus* but are less aggressive and bold. The notes also are weaker, the usual call being a rattling *kee-ee-ee-ees*.

MYIARCHUS TUBERCULIFER LAWRENCEI (Giraud)

Muscicapa lawrencei GIRAUD, Description of sixteen new species of North American birds, 1841, p. 7, pl. 2, fig. 1 ("Texas," probably Nuevo León, Mexico).

Six specimens were obtained near Las Lajas, below Alotenango, on November 5 and 8, and at Panajachel November 12 and 13. Known as *juil*, these birds were fairly common, being found especially in the shade trees of coffee fincas, where I often heard their plaintive calls. The birds taken do not differ from skins from eastern Mexico, the wing measurements being as follows: Four males 84.3, 84.4, 84.7, 85.9; two females 77.2, 80.3 mm.

SAYORNIS NIGRICANS AQUATICA *Sclater and Salvin*

Sayornis aquatica SOLATER and SALVIN, Ibis, 1858, p. 119 (Dueñas, Guatemala).

On October 29 I watched a black phoebe about a water conduit at the Finca San Sebastián, near Dueñas, and remarked that in appearance, actions, and twitching tail it was an exact counterpart of the form found in California. On November 2 I recorded half a dozen about seeps of water in the barren Barranca Honda at 3,800 feet elevation near Alotenango, where that great wash comes down across the beds of volcanic ash at the eastern base of Volcán de Fuego. These birds rested with twitching tails on stones and the top of the earthen banks, calling occasionally, a faint *tsip*.

Two females taken on November 2 have only a feather or two on the under tail coverts tipped narrowly with white. They agree so closely with birds from Costa Rica as to give full support to the statements of van Rossem²⁰ that there is only one form of this phoebe in Central America, which is to be known as *S. n. aquatica*.

EMPIDONAX MINIMUS (Baird and Baird): *Least Flycatcher*

Tyrannula minima W. M. and S. F. BAIRD, Proc. Acad. Nat. Sci. Philadelphia, 1843, p. 284 (Carlisle, Pa.).

The two specimens secured were collected at 3,200 feet elevation below Alotenango on November 3 and 8.

EMPIDONAX HAMMONDII (Xantus)

Tyrannula hammondii XANTUS, Proc. Acad. Nat. Sci. Philadelphia, vol. 10, 1858, p. 117 (Fort Tejon, Calif.).

This was the most common of the genus in the areas where I worked, the birds being found regularly in thickets and open groves up to 7,600 feet, occasionally going higher. They often flitted the wings and jerked the tail and now and then gave soft calls. Specimens were taken as follows: Canderas, October 30 and November 4; Santa María de Jesús, October 31; Panajachel, November 11; and Sierra Santa Elena at 9,500 feet, November 20.

EMPIDONAX AFFINIS AFFINIS (Swainson)

Tyrannula affinis SWAINSON, Phil. Mag., new ser., vol. 1, 1827, p. 367 (maritime parts of Mexico).

The five taken were all obtained among pines at high altitudes. At Sierra Santa Elena they were fairly common, specimens being collected on November 19 and 21. At Desconsuelo on November 24 several were seen about openings in the forest at 10,200 feet, and one

²⁰ Field Mus. Nat. Hist., zool. ser., vol. 23, 1938, pp. 347-348.

was shot. Another was secured on the same date at 10,000 feet at María Tecum. The birds were found often on low perches, sometimes only a yard above the ground. The call note was a sprightly *whit whit* repeated steadily.

Van Rossem has indicated that the present species, called *fulvipectus* in the past, is to be known as *affinis*.²¹

EMPIDONAX FLAVESCENS DWIGHTI van Rossem

Empidonax flavescens dwighti VAN ROSSEM, Auk, 1928, p. 359 (Los Esesmilles, Chalatenango, El Salvador).

On October 29 at 6,500 feet, on the north slope of Volcán de Acate-nango above Dueñas, I shot a male as it rested with twitching tail on an open perch.

The beautifully clear yellowish green of this bird marks it instantly from any of its relatives that I secured. In the identification of this specimen I have had the benefit of the opinion of Robert T. Moore and of the examination of considerable material in this difficult group in his collection while he was working on these specimens in the National Museum.

MYIOCHANES PERTINAX PERTINAX (Cabanis and Heine)

Contopus pertinax CABANIS and HEINE, Museum Heineanum, pt. 2, Sept. 1859, p. 72 (Jalapa, Veracruz).

The first one of these alert flycatchers was taken at 6,500 feet elevation on Volcán de Acate-nango, above Dueñas on November 1. About Chimaltenango on November 7 I saw several in the cypress and other trees bordering lanes and milpas and secured another. At Panajachel two more were collected on November 11 and 12. The birds were rather wild and sought elevated lookout perches. They were called *pingping* by the native boys in evident imitation of their loud notes.

The two taken at Panajachel are distinctly browner than the other two, but all are identified as *pertinax*. It appears probable that there are two forms united under that name at present. There is no approach in the four secured to either *pallidiventris* or *minor*.

MYIOCHANES RICHARDSONII RICHARDSONII (Swainson): Western Wood Pewee

Tyrannula richardsonii SWAINSON, in Swainson and Richardson's Fauna Boreali-Americana, pt. 2, 1831 (1832), p. 146, pl. 46 (Cumberland House, Saskatchewan).

A male taken at the edge of a coffee plantation at 3,400 feet elevation near Las Lajas, below Alotenango, has the following dimensions: Wing 85.7, tail 60.8, culmen from base 14.2, tarsus 13.7 mm. The bill

²¹ Bull. Mus. Comp. Zool., vol. 77, 1934, p. 392.

is dark, and the under surface is extensively gray. A female taken at Panajachel, November 14, from a wire crossing a weed-grown field, agrees in color and though rather small is identified as this migrant race. It measures as follows: Wing 79.0, tail 62.6, culmen from base 14.6, tarsus 13.1 mm.

After a long acquaintance in life with the eastern and western wood pewees I am of the definite opinion that they are specifically distinct groups in spite of their close similarity. The call notes are entirely different. Without further evidence I cannot therefore subscribe to recent statements that make these subspecific representatives of one species.²²

MYIOCHANES RICHARDSONII SORDIDULUS (Sclater)

Contopus sordidulus SCLATER, Proc. Zool. Soc. London, May 1859, p. 43 (Orizaba, Veracruz²³).

A female collected on November 5 at 3,400 feet near Las Lajas, below Alotenango, is small in size and pale in color on throat, with the gray of the sides and breast band paler and browner above than *richardsonii*. It measures as follows: Wing 78.1, tail 56.6, culmen from base 13.8, tarsus 13.1 mm. While not differing greatly in size from the female placed with *richardsonii*, it is distinctly different in color.

MITREPHANES PHAEOCERCUS QUERCINUS Dickey and van Rossem

Mitrephanes phaeocercus quercinus DICKEY and VAN ROSSEM, Proc. Biol. Soc. Washington, vol. 40, Jan. 8, 1927, p. 2 (Mount Cacaguatique, Dept. San Miguel, El Salvador).

On November 1 I secured a female at 6,500 feet elevation on the north face of Volcán de Acatenango. Several seen in this general region were typical small flycatchers in action, ranging on open perches in heavy forest.

While slightly intermediate, this bird is distinctly darker than *M. p. phaeocercus* of southern Mexico. There is another like it in the National Museum from Uspantán in the Department of Quiché, while a bird from Cobán, Alta Vera Paz, is *phaeocercus*.

TYRANNISCUS VILISSIMUS VILISSIMUS (Sclater and Salvin)

Elatnia vilissima SCLATER and SALVIN, Ibis, 1859, p. 122, pl. 4, fig. 1 (Cobán, Alta Vera Paz, Guatemala).

Two taken on November 5 at 3,400 feet elevation near Las Lajas, below Alotenango, came with low, whistled calls to a mistletoe growing in an open tree where I shot the male. A few minutes later I

²² See Dickey and van Rossem, Field Mus. Nat. Hist., zool. ser., vol. 23, 1928, p. 371.

²³ See Hellmayr, Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 5, 1927, p. 192.

saw the female resting quietly in the sun a few feet away and secured her. The disparity in size between male and female is astonishing, the former being fully one-third larger in bulk, a difference readily evident in the following measurements: Male, wing 61.0, tail 52.8, culmen from base 10.2, tarsus 18.3 mm.; female, wing 52.2, tail 41.1, culmen from base 8.9, tarsus 16.2 mm. Both birds are in fresh plumage and agree in the depth of color in the greenish yellow of the sides and flanks.

ONCOSTOMA CINEREIGULARE (Sclater)

Todirostrum cinereigulare SCLATER, Proc. Zool. Soc. London, 1856 (Jan. 26, 1857), p. 256 (Córdoba, Veracruz, Mexico).

While I was trying to follow a whistled bird call in a thicket at 3,200 feet elevation below Alotenango on November 30, a tiny flycatcher flew to a perch in open view. For the moment, intent on the other matter, I paid little attention to it until suddenly it rose to the full length of its legs and uttered a toadlike, trilling note, a call of which I had been vaguely conscious before. The call came constantly for several minutes before I caught sight of the bird again so that I could secure it, to find that it was the bent-billed flycatcher, one of the most curious of its family. The eye was brownish white.

In a good series of this bird in the United States National Museum from southern Mexico to Costa Rica there are only two from the Pacific slope, the bird from Alotenango, and a skin secured by Sumichrast at Tapana, near Santa Efigenia, Oaxaca. The skin from Alotenango, a male, does not differ from specimens from Veracruz. The second bird has an unusually large bill, but there is much variation in this and it is equalled by one specimen from eastern Honduras. I notice no color differences. This is interesting in view of the form recently proposed by Brodkorb,²⁴ which is described as having a larger bill and greener crown with a range on the Pacific lowlands from the Isthmus of Tehuantepec to Costa Rica. Van Rossem²⁵ records, on the other hand, that his skins from El Salvador have slightly smaller and less arched bills than those he had seen from Costa Rica.

Family HIRUNDINIDAE

NOTIOCHELIDON PILEATA (Gould)

Atticora pileata GOULD, Proc. Zool. Soc. London, Nov. 9, 1858, p. 355 (Guatemala).

On the evening of November 26 Axel and Guillermo Pira brought me five of these little swallows, taken from about 30 found sleeping

²⁴ *Oncostoma cinereigulare parifica* Brodkorb, Occ. Pap. Mus. Zool. Univ. Michigan. No. 401, March 1, 1939, p. 7 (Finca Esperanza, Chiapas).

²⁵ Field Mus. Nat. Hist., zool. ser., vol. 23, 1938, p. 390.

in a single hole in a cutbank at an elevation of about 7,500 feet above Tecpam. At Antigua I saw them flying over the town at sunset, when at a little distance they resembled bats. Comparison of the skins secured with others from elsewhere in Guatemala indicates some variation in color of the dorsum, which, however, appears individual, some being decidedly browner than others.

STELGIDOPTERYX RUFICOLLIS FULVIPENNIS (Sclater)

Cotyle fulvipennis SCLATER, Proc. Zool. Soc. London, 1859, p. 364 (Jalapa, Veracruz, Mexico).

Rough-winged swallows were common where the road crossed the wash called Barranca Honda at 3,800 feet elevation near Alotenango, along the eastern base of the Volcán de Fuego. I saw 40 or 50 here from November 2 to 8, and again on November 29 and 30. The notes and appearance of these birds as they turned and circled in the air or rested in little groups on wires beside the road were those common to the roughwing of the United States.

On November 2 I collected two specimens. An adult male has the throat lightly washed with reddish brown, but in an immature female there is only a slight trace of this color on the chin. The latter except for the darker color of the breast and sides is closely similar to the race *serripennis*.

Near Panajachel on November 13 and 14 a flock of several hundred swallows mainly of this group flew over the lake in the evening and at sunset suddenly hurried away to some distant roost along the northern shore.

HIRUNDO RUSTICA ERYTHROGASTER Boddaert: Barn Swallow

Hirundo erythrogaster BODDAERT, Table des planches enluminées, 1783, p. 45 (Cayenne).

Near Dueñas I saw a dozen circling over an open field on October 30 and observed many more on November 1, 3, and 4. Several were noted near Alotenango on November 5. I believed that this marked a period of southward migration when they were especially common. I recorded one at Chimaltenango on November 22.

Family CORVIDAE

CYANOCITTA STELLERI RIDGWAYI Miller and Griscom

Cyanocitta stelleri ridgwayi MILLER and GRISCOM, Amer. Mus. Nov., No. 184, Sept. 24, 1925, p. 7 (Volcán de Fuego, Guatemala).

This jay, known as *chara*, was the commonest species of its family in the highland regions of Guatemala. Its range was higher in the

main than that of *Cissilopha m. melanocyanea*, but there was some overlap between 5,500 and 6,500 feet when the two species occasionally were found in the same woodlands.

On the higher slopes of Volcán de Acatenango these jays were common in dense deciduous forest around 7,500 feet and above, coming down a little lower at times in trees along the roads. Skins were obtained here on October 29 and November 4. Near Chimaltenango I shot one on November 7 from a little flock among pines at 5,700 feet, this being the lowest point at which I observed them. On November 13 I saw them on the hills above Panajachel, and at Sierra Santa Elena, where I prepared three more skins, they were common from November 17 to 27, being especially abundant at 8,600 feet at Chichivac. There was complaint there of their depredations in fields of corn.

These birds were often noisy, a common call being a harsh *shär-r-r shär-r-r*, like that of the crested jays of the United States, but they had other calls that were unfamiliar to me. Once I heard one imitate the scream of the red-tailed hawk. They were found in little flocks that ranged from near the ground to the tops of the tallest trees.

Carlos Pira gave me the skin of a complete albino that he secured near Chichivac.

APHELOCOMA UNICOLOR COELESTIS Ridgway

Aphelocoma unicolor coelestis RIDGWAY, Proc. Biol. Soc. Washington, vol. 16, Sept. 30, 1903, p. 108 (San Cristóbal, Chiapas).

On November 17, in early morning, a pair of these great jays came among the cypress trees near the house at Sierra Santa Elena. They moved slowly from perch to perch, appearing very large in the eddying mist. One was taken. On November 24 I recorded another, and noted that its call was much like that of the California jay, but much louder.

CYANOLYCA PUMILO PUMILO (Strickland)

Cyanocorax pumilo STRICKLAND, in Jardine's Contributions to ornithology, 1849, p. 122, pl. 33 (Guatemala).

On October 27 at the Cuesta San Rafael, above Mixco, at an elevation of 7,000 feet near the boundary between Guatemala and Sacatepéquez, I had a distinct view of one of these jays in a low tree beside the road. When I stopped my car it disappeared instantly. On November 27, at 9,500 feet elevation near Sierra Santa Elena, I heard a curious call and found that it came from a pair of these birds in a grove of trees on the mountainside. A female was taken.

Examination of a small series from Chiapas and Guatemala indicates wing measurements as follows: Male 117.8; females 110, 111.8,

111.8, 112, 114.6 mm. Van Rossem, who has described *C. p. nigrogularis*²⁶ from El Salvador, gives the range of size of his new form in males as 123–128 mm. and in females as 117–118 mm. There is thus a definite size difference. I doubt the color character indicated, however, as my female specimen from Sierra Santa Elena has the lower throat very black, this color extending over on to the sides of the head without break. The two forms seem thus to be separated on size.

There is in the National Museum a female from Cantorál, Honduras, taken by C. F. Underwood on February 10, 1936, that has the wing 117.6 mm., so that it is evidently *nigrogularis*. Hellmayr²⁷ has listed a male from Volcán de Puca, Honduras, and remarks on its size being larger than that of the Guatemalan bird though he lists it under *C. p. pumilo*. This also would appear to be *nigrogularis*.

CISSILOPHA MELANOCYANEA MELANOCYANEA (Hartlaub)

Garrulus (Cyanocorax) melanocyaneus HARTLAUB, Rev. Zool., June 1844, p. 215 (Guatemala).

About Antigua and Dueñas these interesting jays were common and were seen constantly when I was afield. Known to the country people under the name *chara*, which is applied to all jays, they were found in flocks of 6 to 30, sometimes in open forest and often in lines of trees bordering roads. Occasionally they ranged far out through the cornfields, using the scattered shrubbery along barrancas for shelter. I recorded them to 6,500 feet on the north slope of Volcán de Acatenango, which was about their upper limit, as the crested jay appeared just above. The birds call softly and querulously in tones suggesting those of young blue jays and slip about slyly. They were especially noticeable in early morning when they were often along the roads. Below Alotenango I found them common at 3,200 feet, and on November 14 I saw a flock near the Hotel Tsanyuyú at Panajachel. Three specimens were preserved as skins.

Family PARIDAE

PSALTRIPARUS MELANOTIS MELANOTIS (Hartlaub)

Parus melanotis "Sandb." HARTLAUB, Rev. Zool., vol. 7, June 1844, p. 216 (Guatemala).

At Chimaltenango on November 7 I secured two at 5,700 feet from a little flock that fed near the tops of fairly tall trees in a lane of cypress bordering a milpa.

²⁶ *Cyanolyca pumilo nigrogularis* van Rossem, Auk, 1928, p. 363 (Los Esesmlles, Dept. Chalaltenango, El Salvador).

²⁷ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, p. 49.

Family CERTHIIDAE

CERTHIA FAMILIARIS PERNIGRA Griscom

Certhia familiaris pernigra GRISCOM, Ibis, 1935, p. 552 (Volcán de Fuego, Guatemala).

My first creeper was secured at Sierra Santa Elena on November 17, followed by another on November 19. On November 24, Axel Pira and I secured three at an elevation of 10,200 feet near Desconsuelo. They were found usually among pines and seemed to spend more time on the larger limbs than on the main trunks, possibly because the latter were grown so heavily with moss that the bark often was covered entirely and the birds could get no foothold.

With these five fresh skins and two older ones in the National Museum it is easily evident that the birds of Guatemala differ from *C. f. alticola* of southern Mexico in darker color on the back and in the faintly darker shade of the breast and abdomen. In observing these differences I was not aware that they had been noted previously by Griscom, whose name *pernigra* antedates *nubigena* under which I redescribed this race.²⁸

Family CINCLIDAE

CINCLUS MEXICANUS ANTHONYI Griscom

Cinclus mexicanus anthonyi GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 7 (8,250 feet at San Mateo, 45 miles east of Nentón, Guatemala).

On November 24, as I drove across the bridge at Los Arcos, in the Department of Quiché, en route to Desconsuelo, I heard the sharp note of a dipper and pulled off the highway to stop at once. The Río Los Arcos there, at 7,700 feet elevation, was only 6 to 10 feet wide, and ran swiftly over a stony bed between high banks. Two of the birds appeared, and by a fortunate shot I secured one, a female. An old Indian who appeared immediately to ask for this prize to eat was much disappointed at my refusal.

This bird measures as follows: Wing 90.7, tail 49.0, culmen from base 18.8, tarsus 31.1 mm.

Family TROGLODYTIDAE

TROGLODYTES MUSCULUS INTERMEDIUS Cabanis

Troglodytes intermedius CABANIS, Journ. für Orn., 1860, p. 407 (San José, Costa Rica).

I secured three specimens of the house wren, one on October 30, near Canderas, at 7,600 feet, on Volcán de Acatenango, one on October 31,

²⁸ *Certhia familiaris nubigena* Wetmore, Proc. Biol. Soc. Washington, vol. 53, Apr. 19, 1940, p. 51 (Desconsuelo, elevation 10,200 feet, Dept. Totonicapán, Guatemala).

above Santa María de Jesús at 7,800 feet on Volcán de Agua, and one on November 29 near Las Lajas at 3,200 feet below Alotenango. They were found in weeds or thickets along the fences bordering milpas. On November 29 one was heard singing. On December 2 one scolded me from vines over a pergola in the main plaza of Guatemala City. They were known to the natives as the *churrita*.

TROGLODYTES RUFOCILIATUS RUFOCILIATUS Sharpe

Troglodytes rufociliatus SHARPE, Catalogue of the Birds in the British Museum, vol. 6, 1881, p. 262 (10,000 feet elevation on Volcán de Fuego, Guatemala).

At Sierra Santa Elena these woodland wrens were fairly common, ranging from near Chichivac at 8,600 feet to the higher areas at 10,000 feet. They were found about logs in the forest or in dense thickets and came readily at a call to peer and bob, sometimes where the light was so dim that I could barely see them as they moved. Moss-grown dead falls were particularly favored, and from such shelters they scolded me with chattering notes. On the evening of November 25, while Axel Pira, Jr., and I were searching at night for motmots in their roosting holes, we came through a little gate on a trail to a perpendicular bank of black earth 8 feet high. The first few holes in this bank that we examined were empty, but in the last one the beam of the electric torch showed the bright eye and light-colored superciliary stripe of one of these wrens at the far end 3 feet from the entrance. A stick in the hole brought the bird into my hand, and a minute later its companion followed. The nest, whatever it may have been, was in a little depression where I could not reach it. The two secured were male and female.

At Desconsuelo on November 24 I took one at 10,200 feet among fallen branches beneath the pines.

HENICORHINA LEUCOPHRYS CAPITALIS Nelson

Henicorhina leucophrys capitalis NELSON, Auk, 1897, p. 74 (Pinabete, Chiapas).

On the north face of Volcán de Acatenango above Dueñas in a steep, heavily wooded valley I found these wood wrens fairly common and after much watching secured specimens on October 29 and November 1. The birds lived in pairs in dense shadows near the ground where their presence was usually betrayed by their chattering calls. Sometimes three or four were encountered together. Once two appeared within 10 or 15 feet of me without particular fear, though they were adroit in resting so that a branch or a root gave them concealment. The pleasing song, without great carrying power, suggests strongly the pleasant tones of the winter wren both in tone and in method of utterance. At Panajachel on November 13 I heard one singing on

the slopes above the town. In handling specimens I was struck by the very small size of the tail in comparison with the heavy body and strong legs.

HELEODYTES ZONATUS ZONATUS (Lesson)

Picolaptes zonatus LESSON, *Centurie zoologique* . . ., 1832, p. 210, pl. 70 ("Call-fornie").

These cactus wrens of Guatemala are a constant surprise to one who has come to know the genus through the species of the arid sections of the southwestern United States. To follow a flock of birds superficially like ours through heavy undergrowth in a mountain forest where all vegetation is dripping with moisture is new experience, and it is difficult to establish mental association of these southern wrens with their cousins of the arid scrubs and desert sunshine of northern regions.

My first individuals I found on October 30 at 7,600 feet on the slopes of Volcán de Acatenango above Canderas in dense forest, where they were shy and elusive. Others were seen in heavy growth above a little stream near Chimaltenango on November 7, and on November 11 I found others in a dense thicket on a hillside back of Panajachel. On November 21 I followed a little band of four or five over a steep, brush-grown slope at Sierra Santa Elena at 9,500 feet, to emerge after half an hour soaking wet with no specimens, but on November 26 at Chichivac I collected two.

These wrens are found in bands of four to seven or eight that keep close together under cover, where attention is drawn to them by their chattering, scolding calls. They are usually shy but may be decoyed by a careful imitation of their notes. They move alertly, climbing along limbs and branches, searching in moss and epiphytes. At such times the tail hangs loosely, and the birds seem entirely intent on food. They were known to the boys as *chorcha*, and to the Indians at Sierra Santa Elena as *sorojoj*. The iris is pale brownish gray, and the feet and tarsi are olive yellow.

The five specimens preserved as skins are all of the typical form. Hellmayr²⁹ is in error in not recognizing *H. z. restrictus*, which, from specimens in the National Museum, is easily distinguished.

Family MIMIDAE

DUMETELLA CAROLINENSIS (Linnaeus): Catbird

Muscicapa carolinensis LINNAEUS, *Systema naturae*, ed. 12, vol. 1, 1766, p. 328 (Virginia).

Common on December 4 near the beach on a small island opposite Puerto Barrios.

²⁹ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, p. 139.

MELANOTIS HYPOLEUCUS Hartlaub

Melanotis hypoleucus HARTLAUB, Rev. Mag. Zool., ser. 2, vol. 4, Oct. 1852, p. 460 (Guatemala).

On October 30 at 7,600 feet above Canderas on the slopes of Volcán de Acatenango I shot a dark-colored bird of thrasher form as it moved among branches in dense brush and was much surprised to find the white breast of this species when I picked it up. On November 1 at 6,500 feet above Dueñas on the same mountain I saw two or three slipping like shadows through damp, somber undergrowth and secured another. Others were taken and seen on November 13, and 14 in thickets about Panajachel. Here I identified the song, in tone and form suggestive of the brown thrasher (*Toxostoma rufum*), but with occasional thrushlike calls. Many of the notes were in couplets of typical thrasher type, but they were not given regularly, there being many pauses and changes in time. The effort was pleasing and one that I enjoyed.

The somewhat extraordinary suggestion of Hellmayr³⁰ that this white-breasted bird should be rated as a geographic race of *Melanotis caerulescens*, which has the whole breast dull slaty blue, because of certain specimens of *M. c. longirostris* recorded by Nelson from the Tres Marias Islands is wholly without basis. The specimens in question are in the National Museum, and I find that all are albinistic. One with a white breast, being the one that suggests *M. hypoleucus*, has also much white on the lower back, rump, and elsewhere, and two others, which are normal in dark color below, have the ends of the primaries partly white. Obviously these are merely aberrant specimens and have no bearing in linking two species that are quite distinct.

There is in the National Museum a specimen taken by E. W. Nelson and E. A. Goldman on April 3, 1904, at Comitán, Chiapas, apparently the first record for the species from Mexico.

Family TURDIDAE

TURDUS MIGRATORIUS Linnaeus

Turdus migratorius LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 292 (South Carolina).

Migrant robins from the north were observed on November 3 near Dueñas, when a dozen passed high overhead, and on November 23 at 10,000 feet near Sierra Santa Elena, when I recorded two, also in flight.

³⁰ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, p. 304.

TURDUS RUFITORQUES Hartlaub

Turdus (Merula) rufitorques HAETLAUB, Rev. Zool., 1844, p. 214 (Guatemala).

I found this common species first at La Alameda near Chimalteango on November 7, when I shot a beautiful, full-plumaged male. At Sierra Santa Elena they were common and were seen regularly, specimens being taken on November 17 and 19. They were seen in open woodland, or at the edge of heavy forest, preferring most of all small openings bordered by open-branched trees. In such situations they ran about on the ground in search of food, or rested with jerking wings and tail. At any alarm they dashed into heavy cover and immediately were lost to sight. In appearance, movements, and habits they are the exact counterpart of the familiar robin *Turdus migratorius* of the north, and their scolding call notes, heard often from the woods at dusk, were just enough different to enable me to note the distinction. Occasionally at dusk I saw scattering flocks of 15 or 20 individuals passing through the trees to a roost. On November 24 I observed several small groups at Desconsuelo above 10,000 feet and shot a female.

The bill, tarsi, and feet in adult males were honey yellow.

TURDUS GRAYI UMBRINUS Griscom

Turdus grayi umbrinus GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 5 (Finca El Cipres, 2,300 feet, near Mazatenango, Guatemala).

At Panajachel on November 15 one flushed in a dense coffee bush, moving only to the other side, where it remained motionless, so that I was able to locate it with difficulty. Men were working in this section and the bird had learned apparently that it could pass unnoted by remaining quiet. This species is known as *sinsonle de agua*.

While Griscom has listed his specimens from Panajachel as *Turdus g. grayi*, this individual has the darker markings of *umbrinus*.

TURDUS ASSIMILIS RUBICUNDUS (Dearborn)

Planesticus assimilis rubicundus DEARBORN, Field Mus. Nat. Hist., orn. ser., vol. 1, 1907, p. 137 (Patulul, Sololá, Guatemala).

On November 29 I shot a female in the shade trees of a coffee plantation at 3,200 feet elevation near Las Lajas, below Alotenango. Another was seen there the following day.

The specimen agrees fully with the description of this subspecies.

TURDUS PLEBEJUS DIFFERENS (Nelson)

Merula plebata differens NELSON, Proc. Biol. Soc. Washington, vol. 14, Sept. 25, 1901, p. 175 (Pinabete, Chiapas).

Axel Pira, Jr., presented me with a skin of this bird that he had collected at Sierra Santa Elena in May 1936. I saw none alive

The specimen agrees with the type series of *differens*. *Turdus p. rafaelsensis* Miller and Griscom,³¹ though placed in the synonymy of *differens* by Hellmayr,³² appears to me to be easily distinguished. The original series in the American Museum of Natural History, as stated in the description, is exactly intermediate between *differens* and *plebejus*, serving as a link between these two and easily separated from either. Hellmayr has placed *plebejus* and its subspecies as geographic races of *Turdus ignobilis* of South America, but I see no basis for this, at least until intergradation can be shown. *Turdus ignobilis* and its relatives differ in having the lower breast, abdomen, and under tail coverts white, even in the juvenile stage of plumage with spotted breast.

HYLOCICHLA GUTTATA AUDUBONI (Baird): Audubon's Hermit Thrush

Turdus auduboni BAIRD, Review of American birds, June 1864, p. 16 (Fort Bridger Wyo.).

On November 24, near Desconsuelo, Axel Pira, Jr., shot a male among pines at 10,200 feet elevation. This bird is of large size, the wing measuring 103.5 mm.

SIALIA SIALIS GUATEMALAE Ridgway

Sialia sialis guatemalae RIDGWAY, Proc. U. S. Nat. Mus., vol. 5, 1882, p. 13 (Guatemala).

Bluebirds were seen at Dueñas on November 2, near Alotenango on November 5, and near Chimaltenango on November 7. At Sierra Santa Elena they were common on open hillsides and in pasture lands dotted with trees. Five were taken there on November 17, 21, and 23. At Desconsuelo on November 24 they were fairly common over the rolling, open uplands above 10,000 feet. The birds ranged among the shrubbery low down, rested on dead trees, or flew about in little companies, in appearance being exactly like the bluebirds of the north. The ordinary call was generally similar to the fall note of the bluebird of the eastern United States but was sharper in tone.

Family SYLVIIDAE

POLIOPTILA CAERULEA CAERULEA (Linnaeus)

Motacilla caerulea LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 337 (Philadelphia, Pa.)

On November 8 I secured an adult female in a coffee plantation at 3,200 feet near Las Lajas, below Alotenango. The bird was wary but returned constantly to one spot so that I finally secured it.

On November 26 I saw a gnatcatcher at Chichivac above Tecpam.

³¹ Amer. Mus. Nov., No. 183, July 18, 1925, p. 4.

³² Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, p. 391.

Family REGULIDAE

REGULUS SATRAPA AZTECUS Lawrence

Regulus satrapa aztecus LAWRENCE, Ann. New York Acad. Sci., vol. 4, June 1887, p. 66 (City of Mexico).

During my work at Sierra Santa Elena I watched and listened constantly for this tiny bird, until, on November 21, I secured a fine male at 9,500 feet elevation. At Desconsuelo at 10,200 feet on November 24 I saw a number in the tall pines and shot a female. Most of them were so high in the trees that they were out of range, and were very difficult to follow because of their size. In actions and in notes they appeared to me identical with the two northern forms, but their darker color is easily evident. There are two additional males in the National Museum taken by E. W. Nelson and E. A. Goldman at Todos Santos, Huehuetenango, December 28, 1895.

While currently known under the subspecific name *clarus*³³ this race must be called *aztecus* as indicated above. Nelson³⁴ considered the type of *aztecus* as merely a winter migrant of *Regulus s. olivaceus*. And Dearborn in his description of *clarus* said that he had seen this same type and also called it *olivaceus*. Hellmayr³⁵ has expressed doubt in the matter and recently I have compared this type again to find that it is undoubtedly identical with the Guatemalan bird. Lawrence's name must therefore replace *clarus*. The type (Amer. Mus. Nat. Hist. No. 39341) is a male marked "City of Mexico" with no date but is a bird in fresh plumage taken probably in fall or winter. It is distinctly darker in dorsal color than *olivaceus*.

There are specimens of *aztecus* in the U. S. National Museum from Ajusco and Salazar, Distrito Federal, and from Parada, Oaxaca. The name *aztecus* was published also by Ridgway³⁶ and attributed to Lawrence.

Family VIREONIDAE

VIREO HUTTONI VULCANI Griscom

Vireo huttoni vulcani GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 3 (Quetzaltenango, 8,500 feet elevation, Guatemala).

On November 24 I shot an adult male in low bushes at 10,200 feet elevation at Desconsuelo. The eye was brown.

³³ *Regulus satrapa clarus* Dearborn, Field Mus. Nat. Hist., orn. ser., vol. 1, 1907, p. 134 (Sierra Santa Elena, Guatemala).

³⁴ Auk, 1898, p. 160.

³⁵ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 7, 1934, pp. 511-512

³⁶ Manual of North American birds, Sept. 1887, p. 591.

VIREO PALLENS SEMIFLAVUS Salvin

Vireo semiflavus SALVIN, Proc. Zool. Soc. London, 1863, p. 188 (Sakluk, Petén, Guatemala⁷⁷).

On December 4 in swampy thickets back of the beach on a small island opposite Puerto Barrios these birds were found in pairs, and three were taken. Attention was drawn to them by a wrenlike, chattering call. In the three taken the sexual organs were not developed. The iris was brownish white.

In identifying these as *semiflavus* I have followed current understanding of the races of this bird, which from material at hand are not altogether clear to me. The three from Puerto Barrios have extraordinarily large bills, much larger than one from Belize, or a series from Campeche and Yucatán, equaling in this the only specimen I have seen of the duller-colored *V. p. paluster* Moore.

VIREO FLAVIFRONS Vieillot: Yellow-throated Vireo

Vireo flavifrons VIEILLOT, Histoire naturelle des oiseaux de l'Amérique septentrionale, vol. 1, 1807 (1808), p. 85, pl. 54 (Eastern United States).

A female was taken on November 29 at 3,200 feet elevation near Las Lajas, below Alotenango.

VIREO SOLITARIUS SOLITARIUS (Wilson): Blue-headed Vireo

Muscicapa solitaria WILSON, American ornithology, vol. 2, 1810, p. 143, pl. 17, fig. 6 (Bartram's Woods, Philadelphia, Pa.)

A male was taken above Dueñas on November 1, at an elevation of 6,500 feet on the north face of Volcán de Acatenango.

VIREO GILVUS GILVUS (Vieillot): Eastern Warbling Vireo

Muscicapa gilva VIEILLOT, Histoire naturelle des oiseaux de l'Amérique septentrionale, vol. 1, 1807 (1808), p. 65, pl. 34 (New York).

Near Panajachel these migrant vireos were common in dense groves in the valley above the village on November 11 and 15, two being taken on each of these days. On November 29 I found a number in a coffee finca at 3,200 feet elevation near Las Lajas below Alotenango and shot two more. Here they were feeding on wild fruits and came constantly to the fruit-bearing trees, calling querulously. All taken are of the eastern race.

⁷⁷ Baird, Review of American birds, May 1866, pp. 367-368, examined the type of *Vireo semiflavus* Salvin and said that it bore the following data: Collector's No. 428, ♂ Sakluk, Petén, Guatemala, April, 1862, O. Salvin.

HYLOPHILUS OCHRACEICEPS OCHRACEICEPS Sclater

Hylophilus ochraceiceps, SCLATER, Proc. Zool. Soc. London, 1859 (Feb. 1860), p. 375 (Playa Vicente, Oaxaca).

On December 4 these little birds were fairly common in swampy thickets on a low island opposite Puerto Barrios. They were quick in fluttering flights from perch to perch, but when at rest they remained quiet except for the quickly turning head. They were found in pairs, though the male and female that I collected showed no development of the sexual organs.

Family COEREBIDAE

DIGLOSSA BARITULA MONTANA Dearborn

Diglossa montana DEARBORN, Field Mus. Nat. Hist., orn. ser., vol. 1, 1907, p. 125 (Sierra Santa Elena, 9,500 feet, near Tecpam, Guatemala).

Near Sierra Santa Elena these interesting birds were fairly common, being found in weeds and small bushes near the ground or higher up in vine-covered trees. They were alert and active, keeping under shelter and suggesting gnatcatchers somewhat in their mannerisms. I heard a low song, which may be written *tee tee tee tee*, that I attributed to this species. The three taken here include two males on November 18 and 23 and a bird in juvenal dress shot November 21. At María Tecum, where I secured a male on November 24 at 10,000 feet, one that flew below me as I stood on a knoll appeared dark blue above so that at first I did not recognize it.

While the male averages darker than *Diglossa b. baritula* the greater extension of the slate color on the throat seems to be the most prominent character marking *montana*.

I can see no justification for Hellmayr's action³⁸ in linking the distinct *Diglossa plumbea* of Costa Rica as a subspecies of *baritula*, since the characters that join these two are of generic and not of sub-specific value.

Family COMPSOTHTYPIDAE

MNIOTILTA VARIA (Linnaeus): Black and White Warbler

Motacilla varia LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 333 (Hispaniola).

On November 1 I saw several in a wooded valley at 6,500 feet elevation on Volcán de Acatenango above Dueñas, and on November 3 collected an adult male at 3,500 feet below Alotenango near the eastern base of Volcán de Fuego. One was recorded near Chimaltenango on November 7.

³⁸ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, 1935, p. 221.

VERMIVORA PEREGRINA (Wilson): Tennessee Warbler

Sylvia peregrina WILSON, American ornithology, vol. 3, 1811, p. 83, pl. 25, fig. 2 (banks of the Cumberland River, Tenn.).

This northern migrant was common, my first specimen being one shot from a little flock working rapidly through the treetops at 7,800 feet elevation on Volcán de Agua above Santa María de Jesús. I saw one near Dueñas on November 3, and on November 8 shot one and saw others at 3,200 feet elevation below Alotenango. At Panajachel these warblers were abundant from November 11 to 15, three being taken on November 11 and 12. They fed at ripened fruits, such as the jocote, which they perforated for the juices as they do grapes in the north, and also searched the flowers of trees. One that I shot had the throat and forehead yellow with pollen.

VERMIVORA RUFICAPILLA RUFICAPILLA (Wilson): Nashville Warbler

Sylvia ruficapilla WILSON, American ornithology, vol. 3, 1811, p. 120, pl. 27, fig. 3 (near Nashville, Tenn.)

An immature male was taken in a thicket of dense, heavy growth near Panajachel, November 14.

VERMIVORA SUPERCILIOSA SUPERCILIOSA (Hartlaub)

Conirostrum superciliosum HARTLAUB, Rev. Zool., vol. 7, 1844, p. 215 (Guatemala).

Specimens of this handsome warbler were taken at 6,500 feet elevation on Volcán de Acatenango above Dueñas on November 1, near Sierra Santa Elena on November 18 and 20, and at 10,200 feet near Desconsuelo on November 24. The birds were found in deciduous trees, sometimes where such growth was mixed with pine, often in company with little flocks of other warblers. They had the active habits of their near relatives.

DENDROICA MAGNOLIA (Wilson): Magnolia Warbler

Sylvia magnolia WILSON, American ornithology, vol. 3, 1811, p. 63, pl. 23, fig. 2 (Fort Adams, Miss.).

Below Alotenango I shot one at 3,400 feet on November 5 and one at 3,200 feet on November 29.

DENDROICA NIGRESCENS (Townsend): Black-throated Gray Warbler

Sylvia nigrescens TOWNSEND, Journ. Acad. Nat. Sci. Philadelphia, vol. 7, Nov. 21, 1837, p. 191 (Fort William, Portland, Oreg.).

On November 1 I had a distinct view of a black-throated gray warbler in a hedge near Dueñas but did not have opportunity to collect it. I had left my car beside the road and climbed a little bank to

take some photographs when the bird appeared near at hand. It is unfortunate that it was not secured, as there is no record for the species south of southern Mexico.

DENDROICA TOWNSENDI (Townsend): Townsend's Warbler

Sylvia Townsendi "Nuttall" TOWNSEND, Journ. Acad. Nat. Sci. Philadelphia, vol. 7, Nov. 21, 1837, p. 191 (Fort Vancouver, Wash.).

This migrant warbler was common over a considerable area. I took my first on October 31, at 7,800 feet on Volcán de Agua above Santa María de Jesús, where these birds were found in little groves. On November 7 I shot two along a lane of cypress at 5,700 feet near Chimaltenango. The species was next seen at Panajachel, where I collected one on November 15. At Sierra Santa Elena skins were secured on November 18, 19, and 26, the birds being especially numerous near Chichivac among the oaks. Higher up during a day of heavy fog and rain I found one feeding in bushes and even on the ground. On November 29 I recorded one at 3,200 feet elevation below Alotenango. While suggesting the black-throated green warbler in life, Townsend's warbler may be easily told by the definitely dark auricular region and the clear yellow of the breast.

DENDROICA OCCIDENTALIS (Townsend): Hermit Warbler

Sylvia occidentalis TOWNSEND, Journ. Acad. Nat. Sci. Philadelphia, vol. 7, Nov. 21, 1837, p. 190 (Fort Vancouver, Wash.).

At Desconsuelo on November 24 I shot one among low pines at 10,200 feet.

DENDROICA VIRENS VIRENS (Gmelin): Black-throated Green Warbler

Motacilla virens GMELIN, Systema naturae, vol. 1, pt. 2, 1789, p. 985 (Philadelphia, Pa.)

This species was taken with Townsend's warbler on October 31 in a little grove at 7,800 feet on Volcán de Agua, above Santa María de Jesús, a novel experience for one familiar with these two birds in the United States where one is characteristic of the East and the other of the West. One was seen at Panajachel on November 11, and a specimen was taken here two days later. Below Alotenango these warblers were fairly common, being taken on November 3 and 5 and seen on November 8 and 30. The four secured are all of the typical form.

SEIURUS NOVEBORACENSIS NOTABILIS Ridgway

Seiurus naevius notabilis RIDGWAY, Proc. U. S. Nat. Mus., vol. 3, 1880, p. 12 (Como Lake, Carbon County, Wyo.).

On December 4 I saw several water-thrushes of this type on a little cay opposite Puerto Barrios. They walked along the shore more or less under the protection of overhanging limbs or penetrated

the more open sections of the swampy thickets. A male that I shot I have identified as the present race. The wing measured 78.3 mm., and the bird is distinctly gray above.

OPORORNIS TOLMIEI (Townsend): MacGillivray's Warbler

Sylvia Tolmiei TOWNSEND, Narrative of a journey across the Rocky Mountains, Apr. 1839, p. 343 (Fort Vancouver, Wash.).

On October 31 I shot an immature male near the ground in a weed-grown thicket at 7,800 feet on Volcán de Agua, above Santa María de Jesús, and on November 14 secured an immature female in a weed-grown field at Panajachel.

CARDELLINA RUBRIFRONS (Giraud): Red-faced Warbler

Muscioapa rubrifrons GIRAUD, Description of sixteen new species of North American birds, 1841, (p. 27), pl. 7, fig. 1 (Mexico).

On November 1 I collected two and saw others in a wooded valley at 6,500 feet elevation on the north face of Volcán de Fuego, above Dueñas. Another was secured among oaks at Chichivac above Tecpam, November 26. The birds move quickly through the trees feeding in usual warbler fashion.

In addition to these there are three other specimens from Guatemala in the National Museum. On careful comparison with a good series from the mountains of southern Arizona, southern New Mexico, and a few from northern Mexico I am not able to separate the Guatemalan specimens as Griscom has done in describing *Cardellina rubrifrons bella* from Chichicastenango.⁸⁰ These warblers are subject to considerable wear and fading during the breeding season, which lightens their color decidedly, many from the northern group being summer birds in this condition. Griscom's specimens were taken in winter, and those in the National Museum were obtained in October and November. Laying aside the summer specimens in the northern series and using only early spring or winter birds (from northern Mexico), I am not able to detect any difference in shade of red or gray or in the diffusion of reddish wash over the under surface. It appears that all are the same.

ERGATICUS VERSICOLOR (Salvin)

Cardellina versicolor SALVIN, Proc. Zool. Soc. London, 1863, p. 188, pl. 24, fig. 1 (Chilasco, Baja Vera Paz, Guatemala).

These beautiful warblers were fairly common over the mountains from 8,600 feet at Chichivac to above Sierra Santa Elena. Eight skins were taken at the latter point on November 18, 19, 20, 21, and

⁸⁰ Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 2.

23, and two were shot at 10,200 feet at Desconsuelo on November 24. The birds ranged in deciduous growth and in the pines, often in company with migrant warblers from the north. In the dense growth they moved quickly so that it was difficult to keep them in sight, particularly as they were prone to move behind cover, though they were less active than many other warblers. Seen against the light, they appear entirely dark, so that their lovely colors come as a vivid surprise when one appears against the dark green foliage of the trees. They were silent so far as my observation extended.

This species is so distinct in head markings from *Ergaticus ruber* that I can see no basis for Hellmayr's action⁴⁰ in uniting these two as geographic races.

WILSONIA PUSILLA PILEOLATA (Pallas): Northern Pileolated Warbler

Motacilla pileolata PALLAS, Zoographia Rosso-Asiatica, vol. 1, 1811, p. 497 (Kodiak Island, Alaska).

Through the highland portion of Guatemala this was one of the most common and widely distributed of the migrant warblers during my observations. One was seen on November 8, at 3,200 feet elevation below Alotenango, and from here they were encountered to 10,000 feet wherever there was suitable place for them. They ranged from thickets near the ground to the tops of tall trees, moving actively with constantly twitching tails and soft call notes. It is probably these call notes that have brought the name of chip (to be pronounced as in Spanish) to all of the small, yellow-breasted warblers found in Guatemala. The five specimens taken, all *pileolata*, were secured as follows: 6,500 feet elevation Volcán de Acatenango, above Dueñas, October 29; 3,800 feet at the eastern base of Volcán de Fuego near Alotenango, November 2; Panajachel, November 15; and Sierra Santa Elena, November 20.

SETOPHAGA PICTA GUATEMALAE Sharpe

Setophaga guatemalae SHARPE, Catalogue of the birds in the British Museum, vol. 10, 1885, p. 417 (Guatemala).

A female was shot at 8,600 feet elevation from a tree in the garden at Chichivac on November 26.

MYIOBORUS MINIATUS HELLMAYRI van Rossem

Myioborus miniatus hellmayri VAN ROSSEM, Condor, 1936, p. 117⁴¹ (6,000 feet elevation, Volcán de Santa Ana, Department of Sonsonate, El Salvador).

In a wooded valley at 8,600 feet near Chichivac on November 26 I shot a male near the ground in rather dense growth. It moved

⁴⁰ Field Mus. Nat. Hist., zool. ser., vol. 13, pt. 8, 1935, p. 475.

⁴¹ Gives a general discussion of the races north of Costa Rica.

alertly, spreading the tail at times, suggesting a redstart though somewhat less active. Another was observed the following day in a heavily forested area at about 8,700 feet below Calabozo near Sierra Santa Elena. This bird frequented a clearing about a little house where it rested on a fence, on logs, and on other open perches.

IDIOTES RUFIFRONS RUFIFRONS (Swainson)

Setophaga rufifrons SWAINSON, *Animals in menageries*, 1838, p. 294 (Real Arriba, Veracruz).

An immature male was taken at Panajachel. An insistent song of two or three quickly repeated notes that I heard regularly there I finally identified as from these birds. They were found in tangles of vines, thickets, and growths of weeds, where they hid instantly at any alarm.

It is probable that specimens from Guatemala are to be referred to an undescribed race, but much more material is necessary for proper understanding of the southern group in this species.

BASILEUTERUS BELLI SCITULUS Nelson

Basileuterus belli scitulus NELSON, *Auk*, 1900, p. 268 (Todos Santos, Huehuetenango, Guatemala).

Above Dueñas, at 6,500 feet elevation on Volcán de Acatenango, on November 1 I found two or three of these birds in dense herbaceous growth near the ground and collected one. They were in dense shadow and worked about with low, complaining notes. At Chichivac, at 8,600 feet elevation above Tecpam, on November 26 I secured a pair as they fed actively near the ground in the shelter of broad-leaved shrubs.

The races of this species are somewhat difficult as they are based on differences in depth of color, while at the same time there is definite color range individually, specimens taken in fall and winter being darker and those in summer lighter. When this seasonal variation is understood, most of the difficulties of separating the forms disappear. There seems to be no difference in size between any of the races here recognized. A brief review follows:

Basileuterus belli belli (Giraud):

Muscicapa belli GIRARD, *Description of sixteen new species of North American birds*, 1841, pl. 4, fig. 2, and text (Mount Orizaba, Veracruz⁴²).

Chestnut-brown of head darker, particularly on auricular region and about eye, green of dorsal surface, and yellow of lower parts clearer.

⁴² Fixed by Todd, *Proc. U. S. Nat. Mus.*, vol. 74, art. 7, 1929, p. 84.

Wing, male, 55.8–62.1 (three specimens), female, 54.2–59.7 (four specimens).

Veracruz and Oaxaca.

Birds from near Mexico City have been attributed to this race, but these I have not seen. Specimens are at hand from Orizaba and Jico, Veracruz, and from Reyes and Mount Zempoaltepec, Oaxaca.

Basileuterus belli clarus Ridgway:

Basileuterus belli clarus RIDGWAY, U. S. Nat. Mus. Bull. 50, pt. 2, 1902, p. 745 (mountains near Chilpancingo, Guerrero).

Chestnut-brown of head distinctly paler, particularly around eye and on auricular region; green of dorsal surface lighter, brighter; sides and flanks lighter; yellow of under surface slightly paler.

Wing, male, 59.5–62.1 (four specimens), female, 58.2–61.5 (two specimens).

Jalisco, Michoacan, Morelos, and Guerrero.

When specimens secured at the same season are compared, this race may be separated without difficulty, though it was not recognized by Todd.⁴³ The clearer, lighter coloration is evident throughout the plumage. One bird from Huitzilac, Morelos, while slightly intermediate, appears nearer to this race. Other specimens have been seen from San Sebastian, Jalisco, Mount Tancítaro, Michoacan, and Omilteme, and the mountains near Chilpancingo, Guerrero.

Basileuterus belli scitulus Nelson:

Basileuterus belli scitulus NELSON, Auk, 1900, p. 268 (Todos Santos, Huehuetenango, Guatemala).

Similar to *B. b. belli* but green of upper surface distinctly duller, more olive; sides and flanks slightly darker; yellow of underparts averaging a little lighter.

Wing, male, 56.5–65.2 (five specimens), female 59.7–60.7 (three specimens).

Chiapas and Guatemala.

There are specimens of *B. b. scitulus* in the U. S. National Museum from San Cristobal, Chiapas, and from Todos Santos, Uspantán, Dueñas, Calderas, and Tecpam, Guatemala.

Basileuterus belli subobscurus Wetmore:

Basileuterus belli subobscurus WETMORE, Proc. Biol. Soc. Washington, vol. 53, Apr. 19, 1940, p. 52 (Cantorál, Honduras).

Similar to *B. b. scitulus* but definitely darker, grayer, less greenish above; duller on the sides of the neck.

Cerro Cantorál, Honduras.

Known from two specimens in the U. S. National Museum.

⁴³ Loc. cit., pp. 83–84.

Family ICTERIDAE

ICTERUS GALBULA (Linnaeus): Baltimore Oriole

Coracias galbula LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 108 (Virginia).

On October 30 I recorded three small flocks passing through the trees on the slopes of Volcán de Acatenango above Canderas, and at 7,600 feet shot an adult male in full plumage. One was seen at 3,200 feet below Alotenango on November 8.

ICTERUS BULLOCKII (Swainson): Bullock's Oriole

Xanthornus Bullockii SWAINSON, Phil. Mag., new ser., vol. 1, June 1827, p. 436 (Reál del Monte, Hidalgo, Mexico).

The first one obtained was shot on October 31 at 7,800 feet on the north slope of Volcán de Agua above Santa María de Jesús. Another was taken near Chimaltenango on November 7, and a third at Panajachel on November 12. The latter with several others was feeding at the fruit of the jocote.

I see no reason, with the modern information in the form of specimens that is available, for considering *Icterus abeillei* a geographic race of Bullock's oriole. While the females and immature birds are somewhat similar the adult males are clearly and definitely distinct.

ICTERUS SPURIUS (Linnaeus): Orchard Oriole

Oriolus spurius LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 162 (South Carolina).

On November 14 at Panajachel I saw two in a dense thicket bordering weed-grown fields and collected an immature male. This bird was in molt about the head.

CASSIDIX MEXICANUS MEXICANUS (Gmelin)

Corvus mexicanus GMELIN, Systema naturae, vol. 1, pt. 1, 1788, p. 375 (Mexico).

This grackle is one of the prominent birds of Guatemala, as it lives in the open, is of large size, and comes regularly about houses. At Guatemala City on October 26 and 27 and December 2 I saw numbers in plazas, even in the business section, and in the suburbs they were common. At Antigua a pair were constantly in the great cypress tree in the patio at the Popenoe house, and I believed that they were nesting. I was told that during the rainy season in August 200 or more came to roost in the shelter of this same tree.

Above Dueñas I found them in open country on the slopes of Volcán de Acatenango up to 7,300 feet, usually about houses. Near Ciudad Vieja, on November 1, a flock of 30 or 40, all females, flew

out of a cornfield to alight in a tree where I killed two, one adult and one immature. Many seen through the cornfields of this section were in various stages of molt, some being without tails. Near Lake Atitlán they were common but were not so widely distributed as in the valley at Antigua and Dueñas. In evening I noted them in flocks of 50 or 60 along the lake shore, and saw them in flight toward some roost. On December 3 I observed many from the train between Guatemala City and Puerto Barrios, particularly along the Río Motagua.

The country people called the females *sanates* and the males *clarineros*.

TANGAVIUS AENEUS AENEUS (Wagler): Red-eyed Cowbird

Psarocolius aeneus "Lichtenst." WAGLER, Isis von Oken, vol. 22, pt. 7, July 1829, col. 758 (City of Mexico).

On November 2, near Dueñas, I found a flock of 40 or 50 feeding packed closely together on the ground beside the road. They were busily intent on their own affairs and paid little attention as I stopped the car and got out with the gun. I selected two at one side, but as I pulled the trigger the flock was disturbed and I secured 10, a welcome series when I came to examine the birds, as they showed various stages in molt.

Van Rossem⁴⁴ from a study of Wagler's type has found that *aeneus* is the bird currently known as *involucratus* and that the type locality is the City of Mexico.

GYMNOSTINOPS MONTEZUMA (Lesson)

Cacicus Montezuma LESSON, Centurie zoologique, livr. 2, Oct. 1830, p. 33, pl. 7 (Mexico).

At Puerto Barrios on December 4 half a dozen flew overhead with straight, direct flight.

C. W. Richmond in the card catalog in the division of birds, U. S. National Museum, has noted another citation for the original description, viz., *Cassicus Montezuma* Lesson, in Férussac's Bulletin des Sciences Naturelles et de Géologie, vol. 19, December 1829, p. 324, where reference is made to plate "8" (=plate 7) of the Centurie Zoologique published in 1830, with the notation "Espèce nouvelle et très-belle de Cacique du Mexique, à bec rouge et noir, à plumage Marron." This reference I have not seen noted elsewhere.

⁴⁴ Trans. San Diego Soc. Nat. Hist., vol. 7, May 31, 1934, p. 354.

Family THRAUPIDAE

CHLOROSPINGUS OLIVACEUS POSTOCULARIS Cabanis

Chlorospingus postocularis CABANIS, Journ. für Orn., 1866, p. 163 (Sierra above Costa Cuca, Guatemala).

On November 19 at Sierra Santa Elena I secured a female from a little group of four or five that fed actively in open brush near the ground. The white spot behind the eye was a prominent field mark. Another was secured in a similar situation the following day.

PIRANGA RUBRA RUBRA (Linnaeus): Summer Tanager

Fringilla rubra LINNAEUS, Systema naturae, ed. 10, vol. 1, 1758, p. 181 (South Carolina).

An adult male in full red plumage was taken on November 8 in a coffee finca at 3,200 feet below Alotenango. Several were recorded near Panajachel on November 13, and a female was shot in a swampy thicket near Puerto Barrios on December 4.

PIRANGA LUDOVICIANA (Wilson): Western Tanager

Tanagra ludoviciana WILSON, American ornithology, vol. 3, 1811, p. 27, pl. 20, fig. 1 (mouth of Lolo Creek Fork of Clearwater River, western Idaho).

At Panajachel I shot two males on November 11 and a female on November 13. Several others were seen here. On November 29 and 30 I recorded others at 3,200 feet below Alotenango. Tanagers of this group were known to the country people as *kitrik* in obvious imitation of the call of *Piranga r. rubra* and *P. b. sanguinolenta*.

PIRANGA BIDENTATA SANGUINOLENTA Lafresnaye

Piranga sanguinolenta LAFRESNAYE, Rev. Zool., 1838, p. 97 (Mexico).

A male was taken at 6,500 feet on the north slope of Volcán de Acatenango above Dueñas on November 1. The bird worked actively through the lower trees, its call being so similar to that of the summer tanager of the north that I mistook it for that bird until it was in my hand.

THRAUPIS ABBAS (Lichtenstein)

Tanagra Abbas LICHTENSTEIN, Preis-Verzeichniss mexicanischer Vögel, 1830, p. 2 (Mexico).

On November 29 and 30 these tanagers were common at fig trees in a coffee finca at 3,200 feet elevation near Las Lajas, below Alotenango. They moved about singly or in groups of two or three, gathering to feed and then scattering out to other trees to rest. Among the branches their movements were rather deliberate. In flight the yellow spot on the wing was often conspicuous. In two taken on November 29 the intestine was relatively large in size.

TANAGRA ELEGANTISSIMA VINCENS (Hartert)

Euphonia elegantissima vincens HARTERT, Bull. Brit. Orn. Club, vol. 33, Dec. 23, 1913, p. 77 (San José, Costa Rica).

On November 29 and 30 I collected a beautiful pair at 3,200 feet elevation below Alotenango. The birds were found about mistletoe clumps growing in the shade trees of a coffee finca, where my attention was drawn to them by the usual high-pitched, whistled note. Both had the alimentary tract filled with seeds and pulp from mistletoe berries.

I agree with van Rossem that *vincens* is readily distinguished by the darker blue of the crown, and the brighter, clearer green of the dorsal area and more yellowish shade of the lower surface in the female. There is one male of *vincens* in the National Museum taken by Nelson and Goldman at Canjob, Chiapas, May 3, 1904, so that this race extends from extreme southern Mexico to Chiriqui. Possibly the difficulty that Griscom and Hellmayr have had in recognizing it has come from the fact that Hartert in the original description considered that *vincens* ranged only in Costa Rica and southward.

I consider that *elegantissima* has two subspecies and that these two are not geographic races of any of their relatives.

Family FRINGILLIDAE**SALTATOR ATRICEPS ATRICEPS (Lesson)**

Tanagra (Saltator) atriceps LESSON, Centurie zoologique, before May 1832, p. 208, pl. 69 (Mexico).

This strong, robust species is so different in size from the smaller forms of its group that my first encounter with it was a distinct surprise. For days I heard from time to time harsh, explosive calls coming from hidden perches among the leaves at the tops of trees, but always the bird uttering them managed to slip away unseen, and I did not couple these notes with the present species, which I had seen occasionally, until November 30 when I shot a pair at 3,200 feet below Alotenango. They are alert, flying at any alarm. The plumage is harsh and firm and the bird is heavy in body.

HEDYMELES LUDOVICIANA (Linnaeus): Rose-breasted Grosbeak

Loxia ludoviciana LINNAEUS, Systema naturae, ed. 12, vol. 1, 1766, p. 306 (Louisiana).

On October 29 I shot two in the tops of low trees at 6,500 feet on Volcán de Acatenango above Dueñas, and on October 30 and November 4 they were so common near Canderas that I had to examine all treetop birds with field glasses to avoid taking more. On the last date a small flock was seen at 7,000 feet in thick brush. This seemed

to mark a migration period, as afterward I noted only one, on November 14 at Panajachel.

PASSERINA CYANEA (Linnaeus): Indigo Bunting

Tanagra cyanea LINNAEUS, *Systema naturae*, ed. 12, vol. 1, 1766, p. 315 (South Carolina).

Below Alotenango I shot one at 4,800 feet on November 5, and saw two at 3,200 feet on November 30. One was taken near Chimaltenango on November 7. Near Panajachel on November 13, while searching for *Melospiza* in growths of weeds and thickets, I saw a number of indigo buntings and shot three while obtaining specimens of the other species. They were known as *ruis*.

PASSERINA CIRIS CIRIS (Linnaeus)

Emberiza ciris LINNAEUS, *Systema naturae*, ed. 10, vol. 1, 1758, p. 179 (South Carolina).

Near Panajachel I secured two, a female on November 13 and an adult male the following day. One was obtained in the weed-grown thickets where I found indigo buntings and the other in a denser growth nearby. Both belong to the eastern race.

SPINUS PSALTRIA COLOMBIANUS (Lafresnaye)

Carduelis colombianus LAFRESNAYE, *Rev. Zool.*, vol. 6, 1843, p. 202 (Bogotá, Colombia).

At Panajachel on November 14 I secured four from a little flock in a weed-grown field. Two adult males were nearly in breeding condition.

In view of the uncertainty relating to the distinctness of *S. p. croceus*, these are identified as *colombianus*.

SPINUS NOTATUS NOTATUS (Du Bus)

Carduelis notata DU BUS, *Bull. Acad. Roy. Bruxelles*, vol. 14, Aug. 1847, p. 106 (Jalapa, Veracruz).

On November 7 I saw a number along lanes and in open pastures at 5,700 feet near Chimaltenango and shot an adult female. The low, musical notes reminded me of the calls of the western goldfinch. In flight the yellow band in the wings flashed brightly.

SPINUS ATRICEPS (Salvin)

Chrysomitris atriceps SALVIN, *Proc. Zool. Soc. London*, 1863, p. 190 (near Quetzaltenango, Guatemala).

Two specimens of this bird, rare in collections, were taken from a little flock on November 24, at 10,200 feet at Desconsuelo. The throats were partly filled with shelled seeds.

ATLAPETES BRUNNEL-NUCHA BRUNNEL-NUCHA (Lafresnaye)

Embernagra brunnei-nucha LAFRESNAYE, Rev. Zool., Apr. 1839, p. 97 (Mexico).

The present species was found at Sierra Santa Elena in the same dense, low growths inhabited by *Atlapetes g. griseipectus* but was much less common. The passage of dogs through the brush occasionally brought one into sight, but ordinarily they flew a short distance with quickly tilting flight and then disappeared into the dense cover. Occasionally one darted with set wings down some steep slope. The two obtained were shot by Axel Pira, Jr., on November 19 and 25.

ATLAPETES GUTTURALIS GRISEIPECTUS Dwight and Griscom

Atlapetes gutturalis griseipectus DWIGHT and GRISCOM, Amer. Mus. Nov., No. 16, Sept. 9, 1921, p. 3 (Quetzaltenango, 8,500 feet, Guatemala).

At Sierra Santa Elena these birds were fairly common but were seen with some difficulty, since they frequented low growth in rather dense woodland and ordinarily seemed to move aside under cover so that they were not seen. When the dogs accompanied us into the forest and ranged through the brush these finches would sometimes flush and alight for an instant on a low perch, offering a quick shot, and it was thus that we secured our specimens. Of the seven taken on November 18, 19, 21, and 23 five were brought me by Axel Pira, Jr.

In preparing specimens I noted that the sternum was small and the wings rounded, indicating a bird of weak flight. On the other hand, the legs were strong and heavily muscled, showing activity on the ground. The stomach was large and seemed far more prominent than ordinary in the body cavity, the abdominal section of the trunk seeming especially heavy when compared with the weak-muscled anterior portion.

MELOZONE BIARCUATUM (Prévost and Des Murs)

Pyrgita biarcuata PRÉVOST and DES MURS, Voyage autour du monde sur . . . la *Vénus*, Atlas, Oiseaux, 1846, pl. 6 (Guatemala).

On November 4 at 7,600 feet near Canderas I shot one in dense scrub, where it ranged low down near the ground. Others were seen there, but this was the only opportunity that I had to take one. Near Panajachel where the birds were fairly common they were known as *tol*. On November 12 in a weed-grown milpa near the lake shore one flushed to fly a foot or two and then dropped at once into cover. Driven out of this it crossed a little barranca to hide again. Others were seen here and finally I secured one. Another was taken on November 14. At Sierra Santa Elena I recorded several on November 19 in low brush bordering woodland at 9,500 feet. On November

30 I secured an immature specimen at the edge of a thicket at 3,200 feet below Alotenango. The white head markings give a curious effect of albinism at times as they show very prominently. The extreme shyness of this species at this season may have been due in part to the fact that all were in molt.

In a series of 10 from Guatemala I find considerable individual variation that seems to cover the characters cited by Brodkorb in describing a race from Chiapas.⁴⁵ Three skins from Chicharro, Chiapas are identical with one from Laguna, Guatemala, while other Guatemalan skins have a wide range from light to dark.

PIPILO MACULATUS REPETENS Griscom

Pipilo maculatus repetens GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 12 (Zanzon, 8,000 feet, San Marcos, Guatemala).

In the weed-grown fields at 7,800 feet above Santa María de Jesús on October 31, I heard a complaining call, *to-woo*, coming from dense growths, and finally secured one of these birds. On November 4 one was heard at 7,200 feet above Caderas. Near Sierra Santa Elena from November 17 to 26 they were common from 8,600 feet at Chichivac to 10,000 feet above the estancia, where there were thickets and other open places. They did not penetrate the forests. Four were taken here.

AIMOPHILA RUFICAUDA CONNECTENS Griscom

Aimophila ruficauda connectens GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 9 (Progreso, Guatemala).

Through James H. Kempton, of the U. S. Bureau of Plant Industry, I have received two specimens taken on December 8, 1937, at Los Chilamates, Jutiapa, by Raymond Stadelman that represent a new locality for this bird. These two while near *connectens* are definitely darker above and may be found to represent an undescribed form. They are decidedly darker than *A. r. ruficauda*, being more olivaceous and less rufescent, with the flanks darker and duller.

JUNCO ALTICOLA Salvin

Junco alticola SALVIN, Proc. Zool. Soc. London, 1863, p. 189 (Volcán de Fuego, Guatemala).

At Sierra Santa Elena these interesting juncos were common from November 17 to 28, ranging from 8,600 feet at Chichivac to 10,000 feet over the summit of the mountain. Their habits and appearance are typical of the northern forms of the group, from the flash of

⁴⁵ *Melospiza bicarcatum hartwegi* Brodkorb, Occ. Pap. Mus. Zool. Univ. Michigan, No. 369, Apr. 11, 1938, p. 6 (Finca Esperanza, 150 meters elevation, Chiapas).

white in the tail as they flush to their habit of flying up from the ground into the woods to rest in trees when alarmed. They ranged in little flocks along the borders of heavy woods and at the house came familiarly into the garden to feed on strawberries or walk about on the floor of the verandah where I could watch them from the windows. Fallen treetops furnished a cover to which they were partial, and from these they flew up to hide motionless in the dense cover of cypress and pines. At Desconsuelo on November 24 they were common in fairly open woodland at 10,200 feet, and on open grassy slopes 300 feet higher I found them in pairs and little groups in low bushes beneath scattered deciduous trees. Here they flew up into the tree-tops to hide among the abundant parasitic plants that lined the limbs. On this same day at María Tecum, on the slopes below the great sacred rock of the Indians, juncos were present in the weeds and low bushes in dozens, being far more abundant here than at any other spot that I visited. They also came familiarly about the ranchos of the Indians, entering deserted houses without fear.

All were in excellent plumage at this season, and six skins were prepared. Whether this bird is to be treated as a geographic race of *Junco phaeonotus* is a matter still for decision.

The iris in *Junco alticola* is deep golden-yellow.

ZONOTRICHIA CAPENSIS SEPTENTRIONALIS Griscom

Zonotrichia capensis septentrionalis GRISCOM, Amer. Mus. Nov., No. 438, Dec. 15, 1930, p. 12 (Chichicastenango, Guatemala).

Specimens were taken near Chimaltenango on November 7, Panajachel on November 14, and Chichivac above Tecpam on November 26. I saw several on Volcán de Agua above Santa María de Jesús on October 31.

On my first evening in Antigua, looking at the patio in front of my room with its single towering cypress and its clumps of bushes, I hoped for a "*chingolo*" and in the morning I awakened to its familiar, sweetly plaintive song, a pleasure that came almost daily during my stay. Here in Guatemala the birds were known as *coronadas* or *coronalitas*.

INDEX

(New genera, species, etc., are printed in *italics*)

- abbas, *Tanagra*, 576.
 Thraupis, 576.
abditoides, *Ataenius*, 3, 13, 18.
 abditus, *Aphodius* (*Oxyomus*), 20.
 Ataenius, 3, 13, 18, 20.
 abelilei, *Icterus*, 574.
aberrans, *Annularia* (*Annularisca*),
 345, 347.
 abnata, *Parachondria* (*Parachondria*),
 227, 229.
 abnatum, *Chondropoma*, 229.
 Chondropoma (*Chondropomorus*),
 229.
 Cyclostoma, 229.
 abtiana, *Parachondria*, 231.
 Parachondria (*Parachondrops*),
 231, 235.
 Tudora, 235.
 Accalles, 446.
Accipiter striatus velox, 532.
Accipitridae, 532.
Acerotisa, 489.
 baiae, 483 (fig.), 489.
 inconspicuus, 490.
 notulata, 490.
 pellucida, 482.
 acervata, *Annularia* (*Annularops*) *coro-*
nadoi, 296, 297.
 acervatum, *Choanopoma*, 296.
 acherontis, *Cambarus*, 387, 388, 389, 390,
 391 (fig.), 394, 398.
 aciculus, *Ataenius*, 3, 14, 34.
Acotylea, 450.
Acotylina, 450.
Actitis macularia, 536.
 aculeata, *Ophiopholis*, 425, 427.
Adamsiella, 240, 241.
 chordatum, 239.
 (*Cubadamsiella*) *gratiosa*, 241.
 (*Cubadamsiella*) *leoni*, 241, 242.
 (*Cubadamsiella*) *procax*, 241, 243.
Adamsiellinae, 131, 132, 240.
Adamsiellops, 241.
 advena, *Cambarus*, 389, 393.
- Aegialia*, 9.
 aeneus, *Psarocolius*, 575.
 Tangavius aeneus, 575.
 aequata, *Chlaenobia*, 61.
 affinis, *Dendrocolaptes*, 549.
 Empidonax affinis, 552.
 Geococcyx, 539.
 Geococcyx velox, 539.
 Lepidocolaptes affinis, 549.
 Tyrannula, 552.
 agassizii, *Annularia* (*Eutudorisca*), 310,
 312.
 Chondropoma, 312.
 agassizii, *Cistula*, 312.
 Cyclostoma, 312.
 Eutudora (*Eutudorella*), 312.
Agassizocrinus hemisphericus, 515.
 agrestis, *Annularia* (*Troschelindex*),
 327, 337.
 Cistula, 337.
aguayoi, *Tudora* (*Aguayotudora*), 266,
 273.
 Tudora (*Aguayotudora*) *aguayoi*,
 273.
 Xenopoma, 223, 224.
Aguayotudora, 248, 266.
 agulleriana, *Tudora*, 189.
 agullerianum, *Cyclostoma*, 189.
 Opisthosiphon, 189.
 Opisthosiphon (*Bermudezsiphona*),
 168, 189.
 Opisthosiphon (*Bermudezsiphona*)
 agullerianum, 189.
Almophila ruficauda connectens, 580.
 ruficauda *ruficauda*, 580.
alachua, *Cambarus lucifugus*, 387, 389,
 398, 402, 403 (fig.).
alarica, *Hallsidota*, 507.
 alata, *Annularia*, (*Annularisca*), 345,
 350.
 alatum, *Choanopoma*, 350, 351, 371, 373.
 Cistula, 373.
 Cyclostoma, 350.
 Tudora (*Tudorellata*), 351.

- albicincta, *Hemiprocne*, 541.
Streptoprocne zonaris, 541.
 albulia, *Stephanasterias*, 425, 432.
Alcedinidae, 545.
 Alcedo alcyon, 545.
 alcyon, Alcedo, 545.
 Megaceryle, 545.
 alternata, *Brooksella*, 522.
 alticola, *Certhia familiaris*, 559.
 Junco, 580.
Amazilia cyanocephala cyanocephala, 543.
cyanocephala guatemalensis, 543.
 ambiguus, *Psammodius*, 10.
americana, *Digynopora*, 473, 474 (fig.)
Amphiura sundevalli, 425, 427.
 ampla, *Mellita*, 436.
anafense, *Rhytidopoma nodulatum*, 153, 154.
 andrewsi, *Opisthosphon*, 192.
Opisthosphona (Bermudezsiophona), 168, 192.
 angusta, *Leptoplana*, 467, 468, 472, 473, 475.
Stylochoplana, 461, 467.
 ani, *Crotophaga*, 540.
Annularella, 282, 366.
Annularea, 282, 352.
Annularia, 244, 281.
 (*Annularisca*) *aberrans*, 345, 347.
 (*Eutudorisca*) *agassizi*, 310, 312.
 (*Troschelvinde*) *agrestis*, 327, 337.
 (*Annularisca*) *alata*, 345, 350.
 (*Annularia*) *arangiana*, 333.
 (*Troschelvinde*) *arangiana*, 327, 332, 333.
 (*Troschelvinde*) *arangiana arangiana*, 333.
 (*Troschelvinde*) *arangiana cautoensis*, 333.
 (*Troschelvinde*) *arangiana magistra*, 333, 334.
 (*Diplopoma*) *architectonica*, 314, 315, 317.
 (*Diplopoma*) *architectonica architectonica*, 317.
 (*Diplopoma*) *architectonica libanensis*, 317, 318.
 (*Diplopoma*) *architectonica tanaensis*, 317, 318.
 (*Juannularia*) *arguta*, 320, 321, 322.
 (*Juannularia*) *arguta arguta*, 322.
 (*Juannularia*) *arguta insularis*, 322.
Annularia (Annularella) arquesi, 366, 372.
 (*Annularops*) *attenuata*, 290, 297.
 (*Annularops*) *attenuata attenuata*, 297, 298.
 (*Annularops*) *attenuata minacensis*, 297, 298.
 (*Annularops*) *attenuata morsei*, 297, 298.
 (*Annularisca*) *auricoma*, 345, 347, 351.
 (*Annularisca*) *auricoma auricoma*, 348.
 (*Annularisca*) *auricoma putre*, 348, 349.
 (*Troschelvinde*) *barbouri*, 327, 335.
 (*Annularia*) *bebini*, 334.
 (*Troschelvinde*) *bebini*, 327.
 (*Bermudezia*) *bermudezia*, 356.
 (*Lugarenia*) *biayensis*, 360, 361.
 (*Annularops*) *blaini*, 290, 291, 299.
 (*Annularops*) *blaini blaini*, 299, 300.
 (*Annularops*) *blaini cumbrensis*, 299, 300.
 (*Fossularia*) *boqueronensis*, 309.
 (*Eutudora*) *cabrera*, 304.
 (*Eutudorisca*) *camocensis*, 310, 312.
 (*Troschelvinde*) *candeana*, 326, 327, 330.
 (*Troschelvinde*) *candeana candeana*, 330, 331.
 (*Troschelvinde*) *candeana fallax*, 330, 331.
 (*Annularodes*) *canoensis*, 283, 284.
 (*Annularodes*) *cantarillensis*, 283, 285.
 (*Bermudezia*) *capestanyi*, 356, 358.
 (*Eutudorisca*) *catenata*, 310, 313.
 (*Eutudorisca*) *catenata blanesi*, 313, 314.
 (*Eutudorisca*) *catenata catenata*, 313, 314.
 (*Annularops*) *coronadoi*, 290, 295, 296.
 (*Annularops*) *coronadoi acervata*, 296, 297.
 (*Annularops*) *coronadoi coronadoi*, 296.
 (*Annularops*) *coronadoi spurca*, 296, 297.
 (*Annularella*) *cumulata*, 366, 369.
 (*Annularisca*) *eburnea*, 345.
eburnea prestoni, 346.

- Annularia* (*Blaesospira*) *echinus*, 338, 339.
 (*Blaesospira*) *echinus echinus*, 339.
 (*Blaesospira*) *echinus infernalis*, 339, 340.
 (*Blaesospira*) *echinus lucifer*, 339, 340.
 (*Bermudezia*) *euglypta*, 356, 359.
 (*Lugarenia*) *eurystoma*, 360, 361.
 (*Lugarenia*) *eurystoma chorrillensis*, 361.
 (*Lugarenia*) *eurystoma eurystoma*, 361.
 (*Annularosa*) *fragilis*, 364, 365.
 (*Annularosa*) *fragilis fragilis*, 365, 366.
 (*Annularosa*) *fragilis juliani*, 365.
 (*Annularella*) *hendersoni*, 366, 367.
 (*Annularella*) *heyneimanni*, 366, 371.
 (*Annularella*) *holguinensis*, 366, 373.
illustris, 331.
 (*Annularæ*) *incerta*, 352, 354.
 (*Annularia*) *inculta*, 332.
 (*Troschelvindex*) *inculta*, 327, 331
 (*Annularodes*) *indivisa*, 283, 286.
 (*Fossularia*) *inquisita*, 309.
 (*Annularæ*) *intercisa*, 352.
 (*Annularella*) *interstitialis*, 366, 377.
 (*Subannularia*) *jeannereti*, 342, 343.
 (*Troschelvindex*) *jiguanensis*, 327, 328.
 (*Troschelvindex*) *jiguanensis batrensis*, 328, 329.
 (*Troschelvindex*) *jiguanensis jiguanensis*, 328, 329.
 (*Troschelvindex*) *jiguanensis ne grosensis*, 328, 329.
 (*Eutudorisca*) *jimenoi*, 310, 311.
 (*Annularia*) *lachneri*, 342.
 (*Subannularia*) *lachneri*, 342.
 (*Chondropomatus*) *lata*, 383, 384.
 (*Eutudora*) *latistoma*, 304, 308.
 (*Annularella*) *libanoensis*, 366, 370.
 (*Eutudora*) *limbifera*, 303, 304, 308.
 (*Eutudora*) *limbifera limbifera*, 305, 306.
 (*Eutudora*) *limbifera ternata*, 306.
 (*Lugarenia*) *lirata*, 360, 363.
 (*Lugarenia*) *lirata lirata*, 363, 364.
Annularia (*Lugarenia*) *lirata parva*, 363, 364.
 (*Annularæ*) *mackinlayi*, 352, 353.
 (*Annularita*) *majuscula*, 323, 324.
 (*Annularita*) *majuscula catalinensis*, 324, 326.
 (*Annularita*) *majuscula crassilabris*, 324, 325.
 (*Annularita*) *majuscula cumbrensis*, 324.
 (*Annularita*) *majuscula excelsa*, 324, 326.
 (*Annularita*) *majuscula macta*, 324, 325.
 (*Annularita*) *majuscula majuscula*, 324, 325, 326.
 (*Annularita*) *majuscula narcisi*, 324.
 (*Annularella*) *mayariensis*, 367, 381.
 (*Annularella*) *mayariensis canapuenensis*, 381, 382.
 (*Annularella*) *mayariensis mayariensis*, 381, 382.
 (*Annularella*) *mayariensis welchii*, 381.
mayensis, 379.
 (*Annularella*) *mayensis*, 367, 379.
 (*Chondropomatus*) *mimetica*, 383, 385.
 (*Troschelvindex*) *minia*, 327, 336.
 (*Annularia*) *minium*, 336.
 (*Annularodella*) *morenoi*, 302, 303.
 (*Lugarenia*) *najazaensis*, 360, 362.
 (*Lugarenia*) *najazaensis najazaensis*, 362, 363.
 (*Lugarenia*) *najazaensis palomarenensis*, 362, 363.
 (*Annularella*) *natensoni*, 366, 377.
 (*Annularella*) *nipensis*, 366, 375.
 (*Bermudezia*) *obliterata*, 356, 358.
 (*Annularodes*) *obsoleta*, 283, 287.
 (*Diplopoma*) *obsoleta*, 315, 320.
 (*Annularisca*) *pallens*, 345, 350.
 (*Bermudezia*) *payroli*, 356, 357.
 (*Annularodes*) *perezi*, 283, 288.
 (*Annularodes*) *perezi guitarti*, 288, 289.
 (*Annularodes*) *perezi perezi*, 283, 289.
 (*Annularops*) *perplexa*, 291, 302.
 (*Annularia*) *perplicata*, 321.
 (*Juannularia*) *perplicata*, 320.

- Annularia (*Annularodisca*) *pilsbryi*, 289.
 (Diplopoma) *pilsbryi*, 315, 318.
 (Annularops) *plicata*, 291, 298.
 (Annularisca) *prestoni*, 345, 346.
pretrei, 341.
 (Guilbalbona) *pretrei*, 341.
 (Annularella) *pseudalata*, 366, 373.
 (Annularella) *pseudalatum*, 373.
pseudolatum, 373.
ramsdeni, 355.
 (*Annularex*) *ramsdeni*, 352, 355.
 (Diplopoma) *ramsdeni*, 315, 316.
 (Blaesospira) *rocasi*, 338, 340.
 (Troschelindex) *rocasi*, 327, 336.
 (Annularella) *römeri*, 366, 368.
 (Annularops) *sauvallei*, 290, 291.
 (Annularops) *sauvallei chorrenensis*, 291, 292.
 (Annularops) *sauvallei cortinai*, 291.
 (Annularops) *sauvallei natensoni*, 291, 292.
 (Annularops) *sauvallei sauvallei*, 291, 292.
 (Annularops) *semicana*, 290, 193, 294.
 (Annularops) *semicana nana*, 294, 295.
 (Annularops) *semicana organicola*, 294, 295.
 (Annularops) *semicana semicana*, 294, 295.
 (*Lugarenia*) *sifontesi*, 360, 364.
 (Diplopoma) *songoensis*, 315, 319.
 (Annularops) *sordidum*, 297.
spurca, 297.
 (Annularia) *storchi*, 344.
 (*Subannularia*) *storchi*, 342, 344.
 (*Subannularia*) *storchi nipensis*, 344, 345.
 (*Subannularia*) *storchi storchi*, 344.
 (Annularisca) *tacrensis*, 345, 351.
 (Annularella) *tanamensis*, 366, 375.
 (Annularodes) *terneroensis*, 283, 284.
 (Annularodes) *terneroensis indioensis*, 285.
 (Annularodes) *terneroensis terneroensis*, 285.
 (Annularella) *toroensis*, 367, 378.
 (Diplopoma) *torrei*, 315.
 (Annularia) *tracta*, 327.
 (Troschelindex) *tracta*, 327.
- Annularia (*Eutudora*) *transitoria*, 304, 306, 307.
 (*Eutudora*) *transitoria distincta*, 307, 308.
 (*Eutudora*) *transitoria transitoria*, 307, 308.
 (Annularops) *tryoni*, 291, 300.
 (Annularops) *tryoni tryoni*, 301.
 (Annularops) *tryoni vinalensis*, 301.
 (Annularodes) *uncinata*, 282, 283, 284.
 (Annularops) *vannostrandii*, 290, 293.
 (Annularella) *victoris*, 366, 369.
 (Annularella) *wrightii*, 367, 380.
 (Annularella) *yaterasensis*, 366, 370.
 (Annularella) *yumuriensis*, 366, 374.
 (Annularella) *yunquensis*, 366, 367, 379.
- Annulariidae, Cuban operculate mollusks of the family, exclusive of subfamily Chondropominae, 131.
 Annulariinae, 131, 132, 244.
Annularisca, 282, 345.
Annularita, 282, 323.
Annularodella, 281, 302.
Annularodes, 281, 282, 283, 288.
Annularodisca, 281, 289.
Annularops, 281, 290, 302.
Annularosa, 282, 364.
Anoplosiagum, 60.
anthonyi, *Cinclus mexicanus*, 559.
Anthoscenus longirostris pallidiceps, 544.
antoniensis, *Tudora (Eutudorea) troschelli*, 257.
 Anuran amphibians from Mexico, 43.
apertum, *Opisthosiphon (Cubitastphona)*, 199, 212.
Opisthosiphon (Opisthosiphona), 212.
apertus, *Opisthosiphon (Opisthosiphona)*, 212.
Aphelocoma unicolor coelestis, 557.
 Aphodiinae, 1, 2, 3.
 Aphodius, 2, 3, 4.
 (*Oxyomus*) *abditus*, 20.
asper, 9.
chilensis, 25.
cuniculus, 3, 4, 7.
 (*Nialus*) *cuniculus*, 7.
elevatus, 9.
globosus, 9.

- Aphodius imbricatus*, 21.
 lividus, 1, 3, 4, 6.
 (*Labarrus*) *lividus*, 6.
 (*Nialus*) *lividus*, 6.
 luridus, 6.
 marginellus, 36.
 porcatus, 9.
 quadridentatus, 3, 4.
 sabuleti, 9.
 sallei, 1, 3, 4, 5.
 (*Bodilus*) *sallei*, 5.
 sulcicollis, 9.
aquatica, *Sayornis*, 552.
 Sayornis nigricans, 552.
arangiana, *Annularia* (*Annularia*), 333.
 Annularia (*Troschelvindex*), 327, 332, 333.
 Annularia (*Troschelvindex*)
 arangiana, 333.
arangianum, *Choanopoma*, 333.
 Cyclostoma (*Choanopoma*), 333.
Aratinga brevipes, 538.
 canicularis canicularis, 537.
 eburnirostrum, 538.
 holochlora, 538.
 holochlora brewsteri, 538.
 holochlora holochlora, 538.
 holochlora rubritorques, 538.
 holochlora strenua, 538.
Archilochus colubris, 542.
architectonica, *Annularia* (*Diplopoma*), 314, 315, 317.
 Annularia (*Diplopoma*) *architectonica*, 317.
architectonicum, *Cyclostoma* (*Diplopoma*), 317.
 Diplopoma, 317, 318.
arctica, *Plehnia*, 450.
arcticoronata, *Tudora* (*Wrightudora*), 275, 276.
Arctiidae, 501.
arenarius, *Scarabaeus*, 9.
arguta, *Annularia* (*Juannularia*), 320, 321, 322.
 Annularia (*Juannularia*) *arguta*, 322.
argutum, *Chondropoma*, 322.
 Ctenopoma, 322.
arizona, *Listrochelus*, 68, 69.
 Phyllophaga (*Listrochelus*), 112, 123 (fig.).
arquesi, *Annularia* (*Annularella*), 366, 372.
 arquesi, *Colobostylus*, 372.
 Cyclostoma, 372.
Artemesia frigida, 101.
asiatica, *Columba*, 537.
 Zenaida asiatica, 537.
Aspatha gularis, 546.
asper, *Aphodius*, 9.
asperata, *Tudora* (*Aguayotudora*), 266, 272.
assimilis, *Halictis*, 49, 50, 51.
Asterolea, 428.
Ataenius, 4, 10, 12, 32, 35, 37, 39, 40, 41.
 additoides, 3, 13, 18.
 abditus, 3, 13, 18, 20.
 aciculus, 3, 14, 34.
 beattyi, 3, 13, 17.
 brevinotus, 3, 13, 39.
 corrosus, 3, 13, 19.
 cribrithorax, 3, 14, 28.
 darlingtoni, 3, 14, 26, 27, 30, 41.
 edwardsi, 3, 14, 26.
 elongatus, 3, 14, 26.
 exoratus, 18.
 figurator, 15, 16.
 floridanus, 31.
 frankenbergeri, 41.
 frater, 3, 13, 32.
 gracilis, 3, 10, 14, 25.
 haitianus, 35, 36.
 haroldi, 3, 12, 15.
 havanensis, 41.
 imbricatus, 3, 13, 21.
 insulicola, 3, 15, 28, 30.
 jamaicensis, 3, 14, 33.
 llogaster, 3, 14, 27, 28, 29.
 luteomargo, 3, 15, 36, 39.
 miamii, 3, 13, 22, 41.
 nigrolineatus, 34.
 picipes, 23, 24.
 polyglyptus var. *jalapensis*, 18.
 scutellaris, 12.
 sordidus, 21, 22.
 steinheili, 3, 12, 16.
 strigicauda, 3, 14, 31.
 subopacus, 3, 14, 18, 24.
 sulcatulus, 3, 15, 37, 41.
 tenebrosus, 3, 13, 23.
 terminalis, 3, 13, 36, 38.
 versicolor, 3, 14, 35, 36.
 vincentiae, 3, 13, 19.
 waltherhorni, 41.
 Atlantic coast of United States and Canada, polyclad flatworms of, 449.

- atlantica*, *Planctoplanella*, 474 (fig.), 479, 480 (fig.).
- Atlapetes brunnei-nucha brunnei-nucha*, 579.
- gutturalis griseipectus*, 579.
- atomata, *Leptoplanea*, 468.
- Notoplanea*, 457, 468, 469.
- Planaria*, 468.
- atriceps, *Chrysomitris*, 578.
- Saltator atriceps*, 577.
- Spinus*, 578.
- Tanagra* (*Saltator*), 577.
- atricilla, *Larus*, 536.
- Atta, 40.
- attenuata*, *Annularia* (*Annularops*) 290, 297.
- Annularia* (*Annularops*) *attenuata*, 297, 298.
- Atticora pileata, 555.
- auduboni, *Hylotichia guttata*, 564.
- Turdus*, 564.
- audubonii, *Polyborus*, 533.
- Polyborus cheriway*, 533.
- Aulacorhynchus prasinus stenorhynchus*, 547.
- aulaea*, *Haliotis*, 53.
- Auparia ciliata*, 38, 39.
- terminalis*, 38.
- Auperia*, 12.
- rhyticephala*, 37, 38.
- sulcatula*, 37.
- aurantiaca*, *Rhytidothyra bilabiata*, 220, 221.
- auricoma, *Annularia* (*Annularisca*), 345, 347, 351.
- Annularia* (*Annularisca*) *auricoma*, 348.
- Tudora* (*Tudorellata*), 348.
- auricomum, *Choanopoma*, 348.
- Cyclostoma*, 348.
- austina*, *Haliisdota*, 504.
- Automeris, 501.
- hosmera*, 501.
- leucane*, 501.
- azadina*, *Haliisdota*, 505.
- aztecus, *Regulus satrapa*, 565.
- azucarensis*, *Tudora* (*Eutudorea*) *troscelli*, 257, 258.
- bacillum*, *Opisthosiphon* (*Cylindrosiphona*), 215.
- Opisthosiphon* (*Cylindrosiphona*) *bacillum*, 215, 216.
- bahamense*, *Opisthosiphon* (*Opisthosiphon*), 162.
- baiae*, *Acerotisa* 483 (fig.), 489.
- batrensis*, *Annularia* (*Troschelvindex*) *jiguanensis*, 328, 329.
- Balanosphyra formicivora formicivora*, 548.
- formicivora lineata*, 548.
- banaoense, *Opisthosiphon* (*Bermudezsiphona*), 168, 175.
- Opisthosiphon* (*Bermudezsiphona*) *banaoense*, 175, 176.
- baracoensis*, *Parachondria* (*Parachondrops*) *chordata*, 237, 238.
- Tudora* (*Wrightudora*) *garridolana*, 279.
- barbatus*, *Cambarus*, 389, 410, 414, 418.
- barbouri*, *Annularia* (*Troschelvindex*), 327, 335.
- baritula*, *Diglossa baritula*, 567.
- barreti*, *Tudora* (*Aguayotudora*) *recta*, 270, 271.
- barroi*, *Tudora* (*Eutudorea*) *undosa*, 253.
- bartletti*, *Leptasterias*, 425, 430, 432.
- Leptasterias* (*Hexasterias*), 430.
- Bartsch, Paul, on West American *Haliotis*, 49.
- (See also under Torre and Bartsch).
- Basileuterus belli belli*, 572.
- belli clarus*, 573.
- belli scitulus*, 572, 573.
- belli subobscurus*, 573.
- Bassler, Ray, on a supposed Jellyfish from the pre-Cambrian of the Grand Canyon, 519.
- batesi*, *Pleurophorus*, 7, 8.
- beattyi*, *Ataenius*, 3, 13, 17.
- bebini, *Annularia* (*Annularia*), 334.
- Annularia* (*Troschelvindex*), 327.
- Choanopoma*, 334.
- Beetles, West Indian of scarabaeid subfamily Apodilinae, 1.
- bella*, *Cardellina rubrifrons*, 570.
- belli*, *Basileuterus belli*, 572.
- Muscicapa*, 572.
- bermudezi*, *Annularia* (*Bermudezia*), 356.
- Opisthosiphon* (*Bermudezsiphona*), 168, 192.
- Tudora* (*Aguayotudora*), 266, 269.
- Tudora* (*Aguayotudora*) *bermudezi*, 269, 270.

- Bermudezia*, 282, 356.
Bermudezsiphona, 163, 168.
 berryi, Opisthosiphon, 210.
 Opisthosiphon (*Cubitasiphona*),
 199, 209, 210.
 Opisthosiphon (*Cubitasiphona*)
 berryi, 210, 211.
 Opisthosiphon (*Opisthosiphona*),
 210.
 biarcuata, Pyrgita, 579.
 biarcuatum, Melozone, 579.
 biayensis, Annularia (*Lugarenia*), 360,
 361.
 bibijaguense, Opisthosiphon (*Opis-*
thosiphona) pupoides, 194, 195.
 bidens, Psammodytes, 3, 9.
 bidentata, Ophiacantha, 425, 427.
 biedala, Hallsidota, 502.
 bilabiata, ? Clistula, 221.
 Cyclostoma, 221.
 Rhytidothyra, 218, 220, 221.
 Rhytidothyra bilabiata, 220, 221.
 bilabiatum, ? Choanopoma, 221.
 Chondropoma, 221.
 Ctenopoma, 221.
 blocsal, Opisthosiphon (*Cubitasiphona*),
 198, 204.
 Opisthosiphon (*Opisthosiphona*),
 204.
 Opisthosiphon (*Opisthosiphona*)
 blocsal, 204.
 Birds from Guatemalan highlands, 523.
 blackwelderi, Saproscites, 3, 11.
 Blaesospira, 282, 338.
 echinus, 338, 339.
 Blaisospira pretrei, 341.
 blaini, Annularia (*Annularops*), 290,
 291, 299.
 Annularia (*Annularops*) blaini, 299,
 300.
 blandingi, Cambarus, 393.
 blanesi, Annularia (*Eutudorisca*) cate-
 nata, 313, 314.
 bonita, Haliotis, 57.
 booneae, Chondropoma (*Chondropomo-*
rus textum), 229.
 Parachondria (*Parachondria*)
 texta, 228, 229.
 boqueronensis, Annularia (*Fossularia*),
 309.
 brachypterus, Colymbus dominicus, 528,
 529.
 brevinotus, Ataenius, 3, 13, 39.
 brevipes, Aratinga, 538.
 brewsteri, Aratinga holochlora, 538.
 brocchi, Tergipes, 485.
 Thysanozoon, 485.
 Brooksella, 520, 522.
 alternata, 522.
 canyonensis, 522.
 bruneri, Euparixia, 3, 40.
 brunnei-nucha, Atlapetes brunnei-nucha,
 579.
 Embernagra, 579.
 bucaya, Rothschildia, 500.
 bufo, ? Ctenopoma, 261.
 Cyclostoma, 261.
 Ramsdenia, 261.
 Tudora (*Ramsdenia*), 258, 261.
 bullockii, Icterus, 574.
 Xanthornus, 574.
 Bunting, indigo, 578.
 Busycon, 476.
 Buteo jamaicensis, 532.
 jamaicensis calurus, 532.
 jamaicensis costaricensis, 532.
 magirostris, 532.
 nitida micrus, 532.
 cabrasense, Rhytidopoma wrightianum,
 156, 157.
 cabrerai, Annularia (*Eutudora*), 304.
 Cacicus montezuma, 575.
 caerulea, Motacilla, 564.
 Polioptila caerulea, 564.
 caerulescens, Melanotis, 562.
 caesus, Pleurophorus, 8.
 Scarabaeus, 7.
 caguanense, Opisthosiphon (*Bermudez-*
siphona), 168, 185.
 californiana, Haliotis, 51.
 californicus, Colymbus nigricollis, 528.
 Podiceps, 528.
 californiensis, Haliotis, 55, 57.
 Haliotis cracherodii, 56, 57.
 calurus, Buteo jamaicensis, 532.
 calvona, Hallsidota, 508.
 camajanense, Opisthosiphon (*Bermu-*
dez-siphona) palmeri, 170, 171.
 camaronensis, Torrella (*Torrella*) im-
 mersa, 146, 147.
 Cambarus, crayfishes of the genus, p.
 387.
 Cambarus, 387, 393, 410.
 acherontis, 387, 388, 389, 390, 391
 (fig.), 394, 398.
 acherontis pallidus, 394.

- Cambarus advena*, 389, 398.
barbatus, 389, 410, 414, 418.
blandingi, 393.
hubbelli, 387, 389, 406, 407 (fig.) 414, 418.
kildyi, 387, 389, 410, 411 (fig.), 418.
lucifugus, 389, 398.
lucifugus alachua, 387, 389, 398, 402, 403 (fig.).
lucifugus lucifugus, 387, 389, 393, 394, 397, 398, 399 (fig.), 403 (fig.), 405, 406.
pallidus, 387, 389, 394, 395 (fig.).
pictus, 387, 389, 398, 419, 421 (fig.).
pubescens, 389, 398, 423.
rathbunae, 387, 389, 414, 415 (fig.).
rogersi, 410.
camoensis, Annularia (Eutudorisca), 310, 312.
campbelli, Parachondria (Parachondrops), 231.
Camtschatica, 431.
camtschatica, Leptasterias (Hexasterias), 431.
canapuensis, Annularia (Annularella) *mayariensis*, 381, 382.
candearna, Annularia (Troschelvindeix), 326, 327, 330.
 Annularia (Troschelvindeix) *candearna*, 330, 331.
 Cistula, 331.
candearnum, Cistula, 331.
 Cyclostoma, 331.
 Troschelvindeix, 331.
candelaense, Rhytidopoma clathratum, 160, 161.
canetensis, Tudora (Ramsdenia) *natensoni*, 263, 264.
canicularis, Aratinga canicularis, 537.
 Psittacus, 537.
canaoensis, Annularia (Annularodes), 283, 284.
cantarillensis, Annularia (Annularodes), 283, 285.
cantel, Xylophanes, 499.
canyonensis, Brooksella, 522.
Capella delicata, 536.
capestanyi, Annularia (*Bermudezia*), 356, 358.
capillaris, Drosera, 409.
capitalis, Henicorhina leucophrys, 560.
Caprimulgidae, 540.
Caprimulgus minor, 540.
Cardellina rubrifrons, 570.
 rubrifrons bella, 570.
 versicolor, 570.
Carduella colombianus, 578.
 notata, 578.
carminator, Listrochelus, 64, 70, 75.
 Phyllophaga (Listrochelus), 75, 76, 122 (fig.), 130 (fig.).
caroli, Opisthosiphon, 166.
 Opisthosiphon (Solutapex), 163, 166.
carolinensis, Dumetella, 561.
carolinensis, Euplana, 471 (fig.), 472, 475.
carolinensis, Falco Hallaëtus, 533.
 Muscicapa, 561.
 Pandion hallaëtus, 533.
caroliniana, Leodia, 435, 436.
casasense, Opisthosiphon (Opisthosiphona) pupoides, 194.
Cassidix mexicanus mexicanus, 574.
catalinensis, Annularia (Annularita) *majuscula*, 324, 326.
catenata, Annularia (Eutudorisca), 310, 313.
 Annularia (Eutudorisca) *catenata*, 313, 314.
 Cistula, 306.
 Tudora (Eutudorisca), 314.
catenatum, Chondropoma, 314.
 Cistula, 314.
 Cyclostoma, 314.
cautoensis, Annularia (Troschelvindeix) *arangiana*, 333.
cavata, Listrochelus, 60, 63, 68, 103, 104, 106.
 Phyllophaga (Listrochelus), 103, 129 (fig.).
cayana, Playa, 539.
Centurus aurifrons santacruzii, 548.
 Santa Cruzii, 548.
Ceophloeus lineatus similis, 547.
Ceratoplana, 475, 476.
Certhia familiaris alticola, 559.
 familiaris nubigena, 559.
 familiaris pernigra, 559.
Certhiidae, 559.
Ceryle septentrionalis, 545.
chaenobiana, Phytalus, 60, 61.
Chamaepelia passerina var. *pallascens*, 537.

- Chapin, Edward A., on West Indian beetles of the scarabaeid subfamily Aphodiinae, 1.
- chapini*, *Listrochelus*, 66, 70, 82, 83.
Phyllophaga (*Listrochelus*), 84, 124 (fig.), 125 (fig.).
- Charadriidae, 535.
- Charadrius vociferus*, 535.
- chasteria*, *Hallsidota*, 511.
- chilensis*, *Aphodius*, 25.
- Chirodines*, 60, 62.
- Chiroxiphia linearis linearis*, 550.
- Chlaenobia*, 60, 61, 62, 80.
aequata, 61.
colimana, 61.
latipes, 61.
tumulosa, 60, 61.
unituberculata, 61.
vexata, 61.
- Chloroceryle americana septentrionalis*, 545.
isthmica, 545.
- Chlorospingus olivaceus postocularis*, 576.
postocularis, 576.
- Choanopoma acervatum*, 296.
alatum, 350, 351, 371, 373.
aranglanum, 333.
auricomum, 348.
bebini, 334.
bilabiatum, 221.
daudinoti, 236.
decolorata, 265.
eburneum, 345.
echinus, 339.
fragile, 365.
humboldtianum, 223.
(*Blaesospira*) *humboldtiana*, 223.
hystrix, 225.
lachneri, 342.
majusculum, 325.
minium, 336.
(*Ramsdenia*) *mirifica*, 260.
perplicatum, 321.
pilsbryi, 289.
(*Annularodes*) *pilsbryi*, 289
pretrei, 341.
putre, 349.
sauvallei, 292.
storchi, 344.
tractum, 327.
troschelli, 257.
- Choanopoma tryoni*, 301.
uncinatum, 283.
uncinatum indivisum, 286.
(*Annularodes*) *uncinatum indivisum*, 286.
yaterasense, 370.
yunquense, 379.
- Choeridium*, 2.
- Chondropoma*, 228, 235.
abnatum, 229.
(*Chondropomorus*) *abnatum*, 229.
agassizi, 312.
argutum, 322.
bilabiatum, 221.
catenatum, 314.
(*Chondropomorus*) *chordatum*, 239.
elongatum, 322.
erectum, 233.
(*Chondropomorus*) *erectum*, 233.
incultum, 332.
latum, 384.
(*Chondropomatus*) *latum*, 384.
limbiferum, 306.
perplicatum, 321.
ternatum, 305.
textum, 228.
(*Chondropomorus*) *textum*, 228.
(*Chondropomorus*) *textum booneae*, 229.
- Chondropomatus*, 282, 383.
- chordata*, *Parachondria* (*Parachondrops*), 231, 237.
Parachondria (*Parachondrops*)
chordata, 237, 239.
- chordatum*, *Adamsiella*, 239.
Chondropoma (*Chondropomorus*), 239.
Cyclostoma, 239.
- Chordelles minor*, 540.
- chorrerensis*, *Annularia* (*Annularops*)
sauvallei, 291, 292.
- chorrillensis*, *Annularia* (*Lugarenia*)
eurystoma, 361.
Tudora (*Aguayotudora*) *cristata*, 268.
- Chromoplana*, 490.
- Chrysomitris atriceps*, 578.
- ciliata*, A [uparia], 38, 39.
- Cinclidae, 559.
- Cinclus mexicanus anthonyi*, 559.
- cinereigulare*, *Oncostoma*, 555.
Todiostrostrum, 555.
- Circus cyaneus hudsonius*, 533.

- ciris*, *Emberiza*, 578.
Passerina ciris, 578.
Cissilopha melanocyanea melanocyanea, 557, 558.
Cistula agassizii, 312.
 agrestis, 337.
 alatum, 373.
 ? *bilabiata*, 221.
 candearna, 331.
 candeanum, 331.
 catenata, 306.
 catenatum, 314.
 cumulata, 369.
 illustris, 331.
 inculta, 331.
 interstitiale, 367, 375, 377.
 jimenoi, 311.
 limbifera, 306, 307.
 mackinlayi, 353.
 ? *procax*, 243.
 Clark, Austin H., on echinoderms from Greenland collected by Capt. Robert A. Bartlett, 425.
 Clark, Hubert Lyman, revision of the keyhole urchins (*Mellita*), 435.
clarus, *Basileuterus belli*, 573.
 Regulus satrapa, 565.
clathratum, *Ctenopoma*, 161.
 Cyclostoma, 161.
 Rhytidopoma, 150, 159, 160.
 Rhytidopoma clathratum, 160, 161.
claudens, *Opisthosiphon (Cubitasi-phona)*, 198, 201.
cloisa, *Haliisdota*, 505.
Coccyzus erythrophthalmus, 539.
cochisa, *Listrochelus*, 60, 64, 71, 104, 109.
 Phyllophaga (Listrochelus), 105, 129 (fig.).
coelestis, *Aphelocoma unicolor*, 557.
Coerebidae, 567.
Colaptes mexicanoides, 547.
 mexicanoides mexicanoides, 547.
Colibri thalassinus, 543.
colimana, *Chlaenobia*, 61.
collaris, *Trogon*, 544.
Colobostylus, 134, 135.
 arquesi, 372.
 heyneimanni, 371.
 rangelinus, 280.
 rectus, 271.
 roemeri, 368.
 colombense, *Rhytidopoma pinense*, 158, 159.
colombianus, *Carduells*, 578.
 Spinus psaltria, 578.
colubris, *Archilochus*, 542.
 Trochilus, 542.
Columba asiatica, 537.
 fasciata, 536.
 fasciata fasciata, 536.
columbense, *Opisthosiphon (Opisthosiphona) moreletianum*, 195, 196.
Columbidae, 536.
Columbigallina passerina neglecta, 537.
 passerina pallescens, 537.
Colymbidae, 528.
Colymbus dominicus brachypterus, 528, 529.
 nigricollis californicus, 528.
compactus, *Dinotocrinus*, 513, 514, 515.
complanata, *Tudora (Eutudorex)*, 251, 255.
compressus, *Lepidocolaptes souleyetii*, 549.
 Thripobrotus, 549.
Compsothlypidae, 567.
Conirostrum superciliosum, 568.
Conjuguterus, 470.
 parvus, 470.
connectens, *Aimophila ruficauda*, 580.
Contopus pertinax, 553.
 sordidulus, 554.
Conurus holochlorus strenuus, 538.
Copidoplana, 475.
Coracias galbula, 574.
Coronadena, 450, 453.
 mutabilis, 450, 451 (fig.).
coronadoi, *Annularia (Annularops)*, 290, 295, 296.
 Annularia (Annularops) coronadoi, 296.
 Cyclostoma, 296.
coronatum, *Ctenopoma*, 151.
 Cyclostoma, 151.
 Rhytidopoma, 149, 151.
corrosus, *Ataenius*, 3, 13, 19.
corrugata, *Haliotis*, 58.
corrugatus, *Haliotis*, 49.
cortinai, *Annularia (Annularops) sauallei*, 291.
Corvidae, 556.
Corvus mexicanus, 574.
Corythoderini, 2.

- costaricensis, *Buteo jamaicensis*, 532.
Euparixia, 39, 40.
Cotingidae, 550.
Cotyle fulvipennis, 556.
Cotylea, 484.
Cotylinea, 450.
Cowbird, red-eyed, 575.
cracherodii, *Haliotis*, 49, 55, 56.
Haliotis cracherodii, 55.
Craspedommata, 450.
crassilabris, *Annularia* (*Annularita*)
majuscula, 324, 325.
crassiuscula, *Tudora* (*Aguayotudora*),
266, 268.
crassus, *Stylochus*, 491.
cratatus, *Eurhoptodes*, 446, 447 (fig.).
Crayfishes of the genus *Cambarus* from
Florida, 387.
cribrithorax, *Ataenius*, 3, 14, 28.
Crinoidea, 432.
cristata, *Tudora* (*Aguayotudora*), 266,
267, 268.
Tudora (*Aguayotudora*) *cristata*,
268.
croceus, *Spinus psaltria*, 578.
Crossaster papposus, 430.
squamatus, 425, 428.
Crotophaga ani, 540.
sulcirostris, 539.
sulcirostris sulcirostris, 539.
cruentus, *Psammodius*, 9.
Psammodius, 10.
Cryptorhynchine weevils, a new Philip-
pine genus, 445.
Ctenopoma argutum, 322.
bilabiatum, 221.
? *bufo*, 261.
clathratum, 161.
coronatum, 151.
deficiens, 144.
echinatum, 165.
honestum, 151.
immersum, 146.
jeannereti, 343.
nigriculum, 239.
nobilitatum, 259.
nodiferum, 151.
perspectivum, 264.
pulverulentum, 254.
rotundatum, 252.
rugulosum, 153, 154, 155.
sculptum, 167.
Ctenopoma semicoronatum, 278.
torquata, 249.
torrelanum, 143.
tryoni, 301.
undosum, 254.
Cubadamsiella, 240.
Cuban operculate land mollusks of fam-
ily *Annulariidae*, exclusive of sub-
family *Chondropominae*, 131.
Cubitasiphona, 163, 198.
Cuckoo, black-billed, 539.
Cuculidae, 539.
cucullatum, *Opisthosiphon* (*Bermudez-*
siphona), 163, 169.
Cuculus erythrophthalmus, 539.
Cucumaria frondosa, 425, 433.
cumbrensis, *Annularia* (*Annularita*)
majuscula, 324.
Annularia (*Annularops*) *blaini*,
299, 300.
cumulata, *Annularia* (*Annularella*),
366, 369.
Cistula, 369.
Tudora (*Aguayotudora*) *cristata*,
cunaguac, *Opisthosiphon*, 205.
Opisthosiphon (*Cubitasiphona*), 199,
205.
Opisthosiphon (*Opisthosiphon*), 205.
cuniculus, *Aphodius*, 3, 4, 7.
Aphodius (*Nialus*), 7.
cushmani, *Listrochelus*, 68, 107.
Phyllophaga (*Listrochelus*), 109.
cyanea, *Passerina*, 578.
Tanagra, 578.
cyclocephala, *Amazilia cyanocephala*,
543.
cyclocephalus, *Ornismya*, 543.
Cyanocitta stelleri ridgwayi, 556.
Cyanocorax pumilo, 557.
Cyanolyca pumilo nigrogularis, 558.
pumilo pumilo, 557.
Cyathocrinites roemerii, 514, 515.
Cyclostoma abnatum, 229.
agassizii, 312.
agullerianum, 189.
alatum, 350.
(*Choanopoma*) *arangianum*, 333.
(*Diplopoma*) *architectonicum*, 317.
arquesi, 372.
auricomum, 348.
bilabiata, 221.
bufo, 261.

- Cyclostoma candeanum*, 331.
 catenatum, 314.
 chordatum, 239.
 clathratum, 161.
 coronadoi, 296.
 coronatum, 151.
 daudinoti, 236.
 decoloratum, 265.
 deficiens, 144.
 denegatum, 161.
 disjunctum, 196.
 dorbignyanum, 221.
 eburneum, 345.
 echinatum, 165.
 (*Choanopoma*) *echinus*, 339.
 erectum, 233.
 excurrans, 139.
 (*Tudora*) *excurrans*, 139.
 fragile, 365.
 garridoianum, 230.
 heyneimanni, 371.
 honestum, 151.
 illustre, 331.
 immersum, 146.
 incultum, 331.
 interruptum, 305.
 (*Cistula*) *interstitiale*, 377.
 limenoi, 311.
 latum, 384.
 limbiferum, 306.
 lurida, 234.
 luridum, 234.
 mackinlayi, 353.
 mactum, 325.
 majusculum, 325.
 minium, 336.
 moreleti, 196.
 moreletiana, 196.
 nigriculum (*Ctenopoma*), 239.
 nobilitatum, 259.
 nodulatum, 153.
 (*Choanopoma*) *perplicatum*, 320.
 perspectivum, 264.
 pretrei, 341.
 procax, 243.
 pterostomum, 225.
 pulverulentum, 254.
 pupoides, 194.
 rangelinum, 280.
 rotundatum, 252.
 rugulosum, 155.
 salebrosum, 221.
 sculptum, 167.
 semicoronatum, 278.
 Cyclostoma sordidum, 296, 297.
 (*Cyclotus*) *sordidum*, 296.
 textum, 228.
 torquata, 249.
 tractum, 327.
 troscheli, 257.
 undosum, 254.
 (*Ctenopoma*) *vannostrandii*, 293.
 yaterasense, 370.
 yunquense, 379.
Cyclostomus heyneimanni, 371.
 rectus, 271.
 römeri, 363, 372, 373.
 römeri var., 372.
Cylindrosiphona, 163, 215.
 dalli, *Dallsiphona*, 216.
 Hallotis, 55.
 Hallotis (*Padollus*), 55.
 Opisthosiphon, 216.
 Opisthosiphon (*Opisthosiphona*), 216.
Dallsiphona, 133, 216.
 dalli, 216.
daltona, *Halisidota*, 503.
darlingtoni, *Ataenius*, 3, 14, 26, 27, 30, 41.
Dasciocrinus, 515.
daudinoti, *Choanopoma*, 236.
 Cyclostoma, 236.
 Parachondria (*Parachondrops*), 231, 236.
decolorata, *Choanopoma*, 265.
 Tudora (*Gundlachitudora*), 265.
 Tudora (*Tudorellata*), 265.
decoloratum, *Cyclostoma*, 265.
deficiens, *Ctenopoma*, 144.
 Cyclostoma, 144.
 Torrella (*Torrella*), 143, 144.
degeneratum, *Opisthosiphon* (*Bermudezsiphona*) *evanidum*, 183.
 Opisthosiphon (*Opisthosiphona*) *evanidum*, 183.
Delattria henrica salvini, 542.
delicata, *Capella*, 536.
 Scolopax, 536.
delicatum, *Xenopomoides*, 217.
dendriticus, *Trigonoporus*, 454, 456.
Dendrocolaptes affinis, 549.
Dendrocolaptidae, 549.
Dendroica magnolia, 568.
 nigrescens, 568.
 occidentalis, 569.
 townsendi, 569.
 virens virens, 569.

- Dendrotyx hypospodius*, 535.
 leucophrys, 535.
 leucophrys nicaraguae, 534.
dendroscarta, Hyla, 45.
denegatum, Cyclostoma, 161.
densicollis, Listrochelus, 64, 70, 73, 74, 75.
 Phyllophaga (Listrochelus), 74, 122 (fig.), 130 (fig.).
detectum, Opisthosiphon (*Bermudezsiphona*), 168, 190, 191.
 Opisthosiphon (Opisthosiphon), 191.
 Opisthosiphon (*Bermudezsiphona*) *detectum*, 191.
detectus, Opisthosiphon (Opisthosiphona), 191.
deviatum, Opisthosiphon (*Cubitastiphona*), 199, 213.
Diastictus, 8.
 parvulus, 8.
 vulneratus, 8.
diegoensis, *Haliotis corrugata*, 55, 56.
differentis, *Turdus plebejus*, 563.
Diglossa baritula baritula, 567.
 baritula montana, 567.
 plumbea, 567.
Digynopora, 473.
 americana, 473, 474 (fig.).
Dinotocrinus, a new fossil inadunate crinoid genus, 513.
Dinotocrinus compactus, 513, 514, 515.
 roemeri, 514, 515, 516, 517.
 salteri, 514.
Diplopoma, 232, 314, 315.
 architectonicum, 317, 318.
 torrei, 315.
Discocelidae, 450, 453.
Discocelides, 454, 457.
 ellipsoides, 451 (fig.), 454, 455 (fig.).
 langi, 457.
Diacocelis, 450.
 grisea, 450, 453.
 mutabilis, 450, 453.
Discoplana, 470.
disjunctum, Cyclostoma, 196.
disjunctus, Popillius, 10.
disparilis, Listrochelus, 66, 69, 81, 83.
 Phyllophaga (Listrochelus), 81, 118 (fig.), 123 (fig.), 125 (fig.).
distincta, *Annularia (Eutudora) transitoria*, 307, 308.
domara, *Halisidota*, 509.
dorbignyanum, Cyclostoma, 221.
Doricha enicura, 541.
Dove, eastern white-winged, 537.
 Mexican ground, 537.
 western mourning, 536.
dröbachlensis, *Strongylocentrotus*, 425, 433.
Drosera capillaris, 409.
dröwbachensis, *Leptoplana*, 468.
Dryobates sanctorum, 549.
 villosus sanctorum, 549.
Dumetella carolinensis, 561.
duncani, *Euparixia*, 40.
 Listrochelus, 68, 111.
 Phyllophaga (Listrochelus), 111, 123 (fig.).
dupontii, *Ornismya*, 541.
 Tilmatura dupontii, 541.
durangoensis, Listrochelus *cavata*, 103.
dwrighti, *Empidonax flavescens*, 553.
eburnea, *Annularia (Annularisca)*, 345.
eburneum, *Choanopoma*, 345.
 Cyclostoma, 345.
eburnirostrum, *Aratinga*, 538.
echinatum, *Ctenopoma*, 165.
 Cyclostoma, 165.
 Opisthosiphon (Opisthosiphon), 165.
 Opisthosiphon (*Solutapex*), 163.
Echinoderms from Greenland, 425.
Echinoidea, 433.
echinus, *Annularia (Blaesospira)*, 338, 339.
 Annularia (Blaesospira) echinus, 339.
 Blaesospira, 338, 339.
 Choanopoma, 339.
 Cyclostoma (*Choanopoma*), 339.
Ectopistes marginatus, 536.
edwardsi, *Ataenius*, 3, 14, 26.
elegantissima, *Tanagra*, 577.
elevatus, *Aphodius*, 9.
ellipsoides, *Discocelides*, 451 (fig.), 454 (fig.), 455 (fig.).
 Leptoplana, 454, 456, 457, 468, 469.
elliptica, *Planocera*, 459, 460.
ellipticus, *Eustylochus*, 459.
 Stylochus, 455 (fig.), 459, 460, 461.
elongatum, *Chondropoma*, 322.
elongatus, *Ataenius*, 3, 14, 26.
 Scarabaeus, 26.

- elsmersensis, Hallotis, 58.
 Emberiza ciris, 578.
 Embornagra brunnei-nucha, 579.
 Empidonax affinis affinis, 552.
 flavescens dwighti, 553.
 fulvipectus, 553.
 hammondi, 552.
 minimus, 552.
 Enantia, 482.
 pellucida, 482, 483 (fig.).
 spinifera, 482, 484.
 Enantiidae, 481.
 Encope, 436.
 enicura, Doricha, 541.
 enicurus, Trochilus, 541.
 enode, Tudora (*Wrightudora*), 275, 276.
 erecta, Parachondria (*Parachondrops*),
 231, 232, 233, 236.
 Parachondria (*Parachondrops*)
 erecta, 233, 236.
 erectum, Chondropoma, 233.
 Chondropoma (*Chondropomorus*),
 233.
 Cyclostoma, 233.
 ergastulum, Rhytidopoma *pinense*, 158,
 159.
 Ergaticus ruber, 571.
 versicolor, 570.
 erraticus, Scarabaeus, 4.
 erythrea, Leodia, 435, 436.
 erythrogaster, Hirundo, 556.
 Hirundo rustica, 556.
 erythrophthalmus, Coccyzus, 539.
 Cuculus, 539.
 escalerense, Opisthosiphon (*Cubitasi-*
 phona) parcedonense, 214.
 euglypta, Annularia (*Bermudezia*), 356,
 359.
 Euparia, 12.
 Eupariini, 2.
 Euparixia, 3, 39, 40.
 bruneri, 3, 40.
 costaricensis, 39, 40.
 duncani, 40.
 formica, 40, 41.
 Euplana, 470, 475.
 carolinensis, 471 (fig.), 472, 475.
 gracilis, 470.
Eurhoptodes, a remarkable new genus of
 Philippine cryptorhynchine weevils,
 445.
Eurhoptodes cratatus, 446, 447 (fig.).
- Eurhoptus*, 446.
 Eurylepta, 486, 487, 488, 489.
 maculosa, 486.
 Euryleptidae, 486.
eurystoma, Annularia (*Lugarenia*), 360,
 361.
 Annularia (*Lugarenia*) *eurystoma*
 361.
 Eustylochus, 459, 460.
 ellipticus, 459.
 meridionalis, 459, 460.
 Eutudora, 281, 303, 304.
 (*Eutudorella*) *agassizii*, 312.
 (*Eutudorisca*) *jimenoi*, 311.
 (*Eutudora*) *limbifera*, 306.
 (*Eutudorops*) *paradoxum*, 136.
 (*Eutudorops*) *torquata*, 249.
 Eutudorella, 310.
 Eutudorex, 248, 250.
 Eutudorisca, 282, 310.
 Eutudorops, 248.
 evanidum, Opisthosiphon (*Bermudezsi-*
 phona), 168, 182, 183.
 Opisthosiphon (*Bermudezsi*)
 evanidum, 183.
 Opisthosiphon (*Opisthosiphona*)
 evanidum, 183.
excelsa, Annularia (*Annularita*) *majus-*
 cula, 324, 326.
excurrents, Cyclostoma, 139.
 Cyclostoma (*Tudora*), 139.
 Opisthocoeleicum (*Opisthocoelops*),
 138, 139.
 Opisthosiphon (*Opisthosiphona*),
 139.
 Tudora, 139.
exoratus, ? *Ataenius*, 18.
Falco Haliaëtus y *carolinensis*, 533.
 hudsonius, 533.
 jamaicensis, 532.
 sparverius, 533.
 sparverius paulus, 534.
 sparverius peninsularis, 534.
 sparverius phalaena, 534.
 sparverius sparverius, 533.
 velox, 532.
 Falconidae, 533.
fallax, Annularia (*Troschelvindex*) *can-*
 deana, 330, 331.
falsa, *Listrochelus*, 66, 67, 71, 96, 99.
 Phyllophaga (*Listrochelus*), 97, 119
 (fig.), 121 (fig.), 126 (fig.).
falsus, *Listrochelus*, 97.

- fascia, Parachondria, 227.
 Parachondria (Parachondria), 227.
 fasciata, Columba, 536.
 Columba fasciata, 536.
 figurator, Ataenius, 15, 16.
 fimbripes, Listrochelus, 67, 72, 93, 95, 98, 100, 102.
 Phyllophaga (Listrochelus), 95, 120 (fig.), 126 (fig.).
 flavifrons, Vireo, 566.
 flavipennis, Listrochelus, 65, 72, 84, 86, 109.
 Phyllophaga (Listrochelus), 84, 119 (fig.), 127 (fig.).
 Florida, crayfishes from, 387.
 floridana, Gnesioceros, 478.
 Stylochoplana, 478, 479.
 Thais floridana, 477.
 floridanus, Ataenius, 31.
 Oligoclado, 483 (fig.), 487.
 Stylochus, 464, 466.
 Flycatcher, least, 552.
 folium, Leptoplana, 454.
 Trigonoporus, 454, 456, 457.
 formica, Euparixia, 40, 41.
 formicivora, Balanosphyra formicivora, 548.
 fossor, Scarabaeus, 4.
 Fossularia, 282, 308, 309.
 fragile, Choanopoma, 365.
 Cyclostoma, 365.
 fragilis, Annularia (Annularosa), 364, 365.
 Annularia (Annularosa) fragilis, 365, 366.
 frankenbergeri, Ataenius, 41.
 frater, Ataenius, 3, 13, 32.
 frigida, Artemesia, 101.
 Fringilla rubra, 576.
 Fringillidae, 577.
 frondosa, Cucumaria, 425, 433.
 frontalis, Stylochus, 461, 468.
 fulgens, Hallotis, 49, 53, 56, 57.
 fulvipectus, Empidonax, 553.
 fulvipennis, Cotyle, 556.
 Stelgidopteryx ruficollis, 556.
 galbula, Coracias, 574.
 Icterus, 574.
 garciai, Opisthosiphon (Cylindrosiphona) bacillum, 215, 216.
 garciana, Limadora, 245, 247.
 Limadora garciana, 246, 247.
 Ramsdenia, 247.
 garridolana, Tudora (Wrightudora), 275, 279.
 Tudora (Wrightudora) garridolana, 270, 280.
 garridolanum, Cyclostoma, 280.
 Garrulus (Cyanocorax) melanocyaneus, 558.
 gentryi, Listrochelus, 79, 81.
 Geococcyx affinis, 539.
 velox affinis, 539.
 gibbosum, Opisthocoele (Opisthocoele) paradoxum, 135, 136.
 gigas, Podilymbus, 525, 528.
 gilva, Muscicapa, 566.
 gilvus, Vireo gilvus, 566.
 Gnesioceros, 478, 479, 481.
 floridana, 478.
 verrilli, 478.
 glacialis, Heliometra, 425, 432.
 globosus, Aphodius, 9.
 gracile, Prosthlostomum, 470.
 gracilis, Ataenius, 3, 10, 14, 25.
 Euplana, 470.
 Listrochelus, 78.
 Oxyomus (Pleurophorus), 25.
 Psammodius, 25.
 Grand Canyon, a supposed jellyfish from the Precambrian of, 519.
 granti, Listrochelus, 65, 71, 85.
 Phyllophaga (Listrochelus), 85, 121 (fig.), 122 (fig.), 127 (fig.), 130 (fig.).
 gratiosa, Adamsiella (Cubadamsiella), 241.
 grayi, Turdus grayi, 563.
 Grebe, Mexican, 528.
 greenfieldi, Opisthosiphon (Bermudezsiphona), 168, 171.
 Greenland, echinoderms from, 425.
 grenadensis, Saproisites, 3, 11.
 grillensis, Torreila (Torella) immersa, 146, 147.
 grisea, Discocelis, 450, 453.
 griseipectus, Atlapetes gutturalis, 579.
 groenlandica, Leptasterias, 425, 432.
 Leptasterias (Leptasterias), 432.
 Grosbeak, rose-breasted, 577.
 grota, Halisidota, 506.
 guaicanamarensis, Tudora (Aguayotudora) aguayoi, 273, 274.
 guafabanense, Opisthosiphon (Bermudezsiphona) subobtectum, 187, 188.
 Guajaibona, 282, 341.

- guanaense*, *Opisthosiphon* (*Cubita-siphona*), 198, 202.
- quantanamensis*, *Parachondria* (*Parachondrops*) chordata, 237, 238.
- guasana*, *Hallsidota*, 505.
- guatemalae*, *Selasphorus platycercus*, 542.
- Setophaga*, 571.
- Setophaga picta*, 571.
- Sialia sialis*, 564.
- Strix flammea* var., 540.
- Tyto perlata*, 540.
- Guatemalan highlands, birds from, 523.
- guatemalensis*, *Amazilia cyanocephala*, 543.
- guatimalensis*, *Pitangus sulphuratus*, 551.
- Saurophagus*, 551.
- guayosense*, *Opisthosiphon* (*Bermudez-siphona*) obtectum, 178, 180.
- guitarti*, *Annularia* (*Annularodes*) *perezi*, 288, 289.
- gularis*, *Aspatha*, 546.
- Prionites*, 546.
- Gull, laughing, 536.
- gundlachi*, *Tudora* (*Wrightudora*), 275, 277.
- Gundlachtudora*, 248, 265.
- Gutierrezia* sp., 101.
- guttulatus*, *Syrhrophus*, 45.
- Gymnostinops montezuma*, 575.
- haltianus*, *Ataenius*, 35, 36.
- Hallotis*, West American, 49.
- Hallotis assimilis*, 49, 50, 51.
- aulaea*, 53.
- bonita*, 57.
- californiana*, 51.
- californiensis*, 55, 57.
- corrugata*, 58.
- corrugata dleogensis*, 55, 56.
- corrugatus*, 49.
- cracherodii*, 49, 55, 56.
- cracherodii californiensis*, 56, 57.
- cracherodii cracherodii*, 55.
- cracherodii holzneri*, 55, 56.
- cracherodii imperforata*, 55, 56.
- cracherodii splendidula*, 55, 56.
- dalli*, 55.
- (*Padollus*) *dalli*, 55.
- elsmerensis*, 58.
- fulgens*, 49, 53, 56, 57.
- Hallotis fulgens walallensis*, 51.
- kamtschatkana*, 49, 54, 55, 58.
- koticki*, 58.
- lasia*, 57.
- lomaensis*, 57.
- palea*, 57.
- planilirata*, 53.
- ponderosa*, 49, 52.
- rosea*, 55, 56.
- rufescens*, 49, 51, 58.
- rufescens hattorii*, 52.
- rufescens rufescens*, 51, 52, 53.
- rufescens walallensis*, 51, 52.
- smithsoni*, 54.
- sorenseni*, 49, 50.
- splendens*, 53.
- walallensis*, 49, 51.
- Hallsidota*, 501.
- alarica*, 507.
- austina*, 504.
- azadina*, 505.
- biedala*, 502.
- calvona*, 508.
- chesterta*, 511.
- cloisa*, 505.
- daltona*, 503.
- domara*, 509.
- gropa*, 506.
- guasana*, 505.
- ishima*, 503.
- joasa*, 504.
- loisöna*, 503.
- lomara*, 508.
- louella*, 502.
- manada*, 509.
- martona*, 507.
- misona*, 508.
- nayupana*, 506.
- nella*, 508.
- potamia*, 510.
- siegruna*, 509.
- soldina*, 504.
- sporina*, 510.
- suavina*, 510.
- terola*, 502.
- toledana*, 507.
- zacualpana*, 501.
- hammondii*, *Empidonax*, 552.
- Tyrannula*, 552.
- haroldi*, *Ataenius*, 3, 12, 15.
- hartwegi*, *Melozona biarcuatum*, 580.
- hattorii*, *Hallotis rufescens*, 52.
- havanensis*, *Ataenius*, 41.

- Hawk, eastern sparrow, 533.
marsh, 533.
- Hedymeles ludoviciana*, 577.
- Heleodytes zonatus restrictus*, 561.
zonatus zonatus, 561.
- Heliomaster pallidiceps*, 544.
- Heliometra glacialis*, 425, 432.
- hellmayri, *Myioborus miniatus*, 571.
- Hemiprocne albicincta*, 541.
- hemisphericus*, *Agassizocrinus*, 515.
- hendersoni*, *Annularia* (*Annularella*), 366, 367.
Xenopoma, 223, 225, 226, 227.
- Henicorhina leucophrys capitalis*, 560.
- Henricia sanguinolenta*, 425, 423.
- Heron, great blue, 530.
- hespericum*, *Rhytidopoma*, 150, 161.
- Heterocerous moths in the United States National Museum, 497.
- Hexasterias*, 425, 431.
- heynemanni*, *Annularia* (*Annularella*), 366, 371.
Colobostylus, 371.
Cyclostoma, 371.
Cyclostomus, 371.
Tudora (*Tudorellata*), 371.
- Hirundinidae*, 555.
- Hirundo erythrogaster*, 556.
rustica erythrogaster, 556.
- Hobbs, Horton H., Jr., on seven new crayfishes of the genus *Cambarus* from Florida, with notes on other species, 387.
- holguinense*, *Opisthosiphon aguillerianum*, 190.
Opisthosiphon (*Bermudezsiphona*) aguillerianum, 190.
- holguinensis*, *Annularia* (*Annularella*), 366, 373.
- holochlora*, *Aratinga*, 538.
Aratinga holochlora, 538.
- Holothuroidea*, 433.
- holzneri, *Haliotis cracherodii*, 55, 56.
- honestum*, *Ctenopoma*, 151.
Cyclostoma, 151.
Rhytidopoma, 149, 150, 151.
Rhytodopoma honestum, 150, 151.
- Hoploplana*, 476.
inquillina, 476, 477.
inquillina thaisana, 477.
thaisana, 477.
- Hoploplanidae*, 476.
- hosmera*, *Automeris*, 501.
- huachuca*, *Listrochelus*, 66, 69, 82, 84.
Phyllophaga (*Listrochelus*), 82, 124 (fig.), 125 (fig.), 130 (fig.).
- huascara*, *Protoparce*, 498.
- hubbelli*, *Cambarus*, 387, 389, 406, 407 (fig.), 414, 418.
- hudsonius*, *Circus cyaneus*, 533.
Falco, 533.
- humboldtiana*, *Choanapoma* (*Blaesospira*), 223.
Xenopoma, 223.
- humboldtianum*, *Choanopoma*, 223.
Xenopoma, 223.
- Hummingbird, ruby-throated, 542.
- huntsvillae*, *Scaphiocrinus*, 514, 515.
- Hyla*, 45.
dendroscarta, 45.
melanomma, 47.
- Hylocharis leucotis*, 543.
- Hylocihla guttata auduboni*, 564.
- Hylophilus ochraceiceps*, 567.
ochraceiceps ochraceiceps, 567.
- Hyman, Libbie H., on polyclad flatworms of the Atlantic coast of the United States and Canada, 449.
- Hymania prytherchi*, 487, 488, 489.
- hypoleucus*, *Melanotis*, 562.
- hypospodius*, *Dendrotyx*, 535.
- hypugaea*, *Speotyto cunicularia*, 540.
Strix, 540.
- hystrix*, *Choanopoma*, 225.
Xenopoma, 223, 225, 227.
- Icteridae*, 574.
- Icterus abellei*, 574.
bullockii, 574.
galbula, 574.
spurius, 574.
- Idiotes rufifrons rufifrons*, 572.
- ignobilis*, *Turdus*, 564.
- illustre*, *Cyclostoma*, 331.
- illustris*, *Annularia*, 331.
Cistula, 331.
Troschelvindex, 331.
- imbricatus*, *Aphodius*, 21.
Ataenius, 3, 13, 21.
- immersa*, *Torrella* (*Torrella*), 143, 145, 146.
Torrella (*Torrella*) immersa, 146.
- immersum*, *Ctenopoma*, 146.
Cyclostoma, 146.
- Imogine*, 459, 466.
- oculifera*, 464, 466, 478.

- imperforata*, *Haliotis cracherodii*, 55, 56.
incerta, *Annularia* (*Annulæx*), 352, 354.
incincta, *Playa cayana*, 539.
inconspicuus, *Acerotisa*, 490.
incolta, *Annularia* (*Annularia*), 332.
Annularia (*Troschelvindex*), 327, 331.
Cistula, 331.
incultum, *Chondropoma*, 332.
Cyclostoma, 331.
indiocensis, *Annularia* (*Annularodes*) *terneroensis*, 285.
indivisa, *Annularia* (*Annularodes*), 283, 286.
indivisum, *Choanopoma uncinatum*, 286.
Choanopoma (*Annularodes*) *uncinatum*, 286.
infernalis, *Annularia* (*Blaesospira*) *echinus*, 339, 340.
inimicus, *Stylochus*, 461, 462, 468.
iniquilina, *Hoploplana*, 476, 477.
Planocera, 476.
inquisita, *Annularia* (*Fossularia*), 309.
insignis, *Lepidocolaptes souleyetii*, 549.
insulanum, *Opisthosiphon* (*Bermudezsiphona*), 168, 180.
Opisthosiphon (*Bermudezsiphona*) *insulanum*, 180, 181.
insularis, *Annularia* (*Juannularia*) *arguta*, 322.
insulicola, *Ataenius*, 3, 15, 23, 30.
intercisa, *Annularia* (*Annulæx*), 352.
intermedius, *Troglodytes musculus*, 559.
interruptum, *Cyclostoma*, 305.
interstitiale, *Cistula*, 367, 375, 377.
Cyclostoma (*Cistula*), 377.
interstitialis, *Annularia* (*Annulærella*), 366, 377.
Tudora (*Tudorellata*), 377.
involucrat, *Tangavius*, 575.
ishima, *Hallsidota*, 503.
isthmica, *Chloroceryle*, 545.
itinerans, *Rhytidopoma honestum*, 150.
jalapensis, ? *Ataenius polyglyptus* var., 18.
jamaicensis, *Ataenius*, 3, 14, 33.
jamaicensis, *Buteo*, 532.
Falco, 532.
jeannereti, *Annularia* (*Subannularia*), 342, 343.
Ctenopoma, 343.
jeannereti, *Parachondria* (*Parachondrops*), 343.
jiguanensis, *Annularia* (*Troschelvindex*), 327, 328.
Annularia (*Troschelvindex*) *jiguanensis*, 328, 329.
jimenoi, *Annularia* (*Eutudorisca*), 310, 311.
Cistula, 311.
Cylostoma, 311.
Eutudora (*Eutudorisca*), 311.
joasa, *Hallsidota*, 504.
Juannularia, 282, 320.
judacensis, *Opisthosiphon* (*Opisthosiphona*), 206.
judasense, *Opisthosiphon* (*Cubitasiphona*), 199, 206.
Opisthosiphon (*Opisthosiphon*), 206.
juliani, *Annularia* (*Annularosa*) *fragilis*, 365.
jumaguense, *Rhytidopoma clathratum*, 160.
Junco alticola, 580.
phaeonorotus, 581.
kamtschatkana, *Haliotis*, 49, 54, 55, 58.
katherinae, *Xylophanes*, 499.
Keyhole urchins (*Mellita*), revision of 435.
kilbyi, *Cambarus*, 387, 389, 410, 411 (fig.), 418.
Killdeer, 535.
Kingbird, *Cassin's*, 551.
Kingfisher, belted, 545.
Kirk, Edwin, *Dinotocrinus*, a new fossil inadunate crinoid genus, 513.
koehleriana, *Listrochelus*, 67, 71, 93, 97, 101, 102.
Phyllophaga (*Listrochelus*), 99, 120 (fig.), 128 (fig.).
koticki, *Haliotis*, 58.
lachneri, *Annularia* (*Annularia*), 342.
Annularia (*Subannularia*), 342.
Choanopoma, 342.
lamellicostatum, *Opisthocoeleum* (*Opisthocoeleum*), 141, 142.
Opisthocoeleum (*Opisthocoeleum*) *lamellicostatum*, 142.
Opisthosiphon (*Opisthosiphon*), 142.
lamellosum, *Opisthosiphon* (*Bermudezsiphona*), 168, 172.
Opisthosiphon (*Bermudezsiphona*) *lamellosum*, 172, 173.

- Lampornis amethystinus salvini*, 542.
Lamprolaima rhami rhami, 543.
langeri, *Listrochelus*, 97.
langi, *Discocelides*, 457.
laportae, *Listrochelus*, 59.
Laridae, 536.
Larus atricilla, 536.
lasia, *Haliotis*, 57.
lata, *Annularia* (*Chondropomatus*), 383, 384.
lata, *Mellita*, 437, 440, 441.
latiambulacra, *Mellita*, 437, 439.
latipes, *Chlaenobia*, 61.
latistoma, *Annularia* (*Eutudora*), 304, 308.
Latocestidae, 457.
Latocestus, 457, 459.
 sp. 568.
 whartoni, 455 (fig.), 458.
latum, *Chondropoma*, 384.
 Chondropoma (*Chondropomatus*), 384.
 Cyclostoma, 384.
laureanti, *Tudora* (*Eutudorea*) *undosa*, 253.
lawrenceli, *Muscicapa*, 551.
 Mylarchus tuberculifer, 551.
Leodia, 435, 436.
 caroliniana, 435, 436.
 erythrea, 435, 436.
 pacifica, 435, 436.
 sexiesperforata, 435.
leoni, *Adamsiella* (*Cubadamsiella*), 241, 242.
Lepidocolaptes affinis affinis, 549.
 souleyetii compressus, 549.
 souleyetii insignis, 549.
Leptasterias, 425.
 bartletti, 425, 430, 432.
 (*Hexasterias*) *bartletti*, 430.
 (*Hexasterias*) *camtschatica*, 431.
 groenlandica, 425, 432.
 (*Leptasterias*) *groenlandica*, 432.
 polaris, 425, 431, 432.
 sp., 425.
 (*Leptasterias*) *sp.*, 432.
Leptoplana, 468.
 angusta, 467, 468, 472, 473, 475.
 atomata, 468.
 dröwbachensis, 468.
 ellipsoides, 454, 456, 457, 468, 469.
 follum, 454.
 variabilis, 468, 469.
 virilis, 468, 469.
Leptoplanidae, 467.
lessoni, *Momotus*, 546.
 Momotus lessoni, 546.
leucane, *Automeris*, 501.
leucophrys, *Dendrortyx*, 535.
leucotis, *Hylocharis leucotis*, 543.
 Trochilus, 543.
libanoensis, *Annularia* (*Annularella*), 366, 376.
 Annularia (*Diplopoma*) *architectonica*, 317, 318.
Limadora, 132, 244, 245.
 garciana, 245, 247.
 garciana garciana, 246, 247.
 garciana sillaensis, 246, 247.
 scabrata, 245, 247.
 tollini, 245.
Limadorex, 132, 244.
 limonensis, 244.
limbifera, *Annularia* (*Eutudora*), 303, 304, 308.
 Annularia (*Eutudora*) *limbifera*, 305, 306.
 Cistula, 306, 307.
 Eutudora (*Eutudora*), 306.
limbiferum, *Chondropoma*, 306.
 Cyclostoma, 306.
limonensis, *Limadorex*, 244.
lincina, *Turbo*, 281.
linearis, *Chiroxiphia linearis*, 550.
 Pipra, 550.
lineata, *Balanosphyra formicivora*, 548.
logaster, *Ataenius*, 3, 14, 27, 28, 29.
Liogenys, 61.
lirata, *Annularia* (*Lugarenia*), 360, 363.
 Annularia (*Lugarenia*) *lirata*, 363, 364.
Listrochelus, subg., from United States, 59.
Listrochelus, 59, 63, 68, 72.
 arizona, 68, 69.
 carminator, 64, 70, 75.
 cavata, 60, 63, 68, 103, 104, 106.
 cavata durangoensis, 103.
 chapini, 63, 70, 82, 83.
 cochisa, 60, 64, 71, 104, 109.
 cushmani, 68, 107.
 densicollis, 64, 70, 73, 74, 75.
 disparilis, 66, 69, 81, 83.
 duncani, 68, 111.
 falsa, 66, 67, 71, 96, 99.
 falsa nogales, 66, 68.
 falsus, 97.

- Listrochelus fimbripes*, 67, 72, 93, 95, 98, 100, 102.
flavipennis, 65, 72, 84, 86, 109.
gentryi, 79, 81.
gracilis, 78.
granti, 65, 71, 85.
huachuca, 68, 69, 82, 84.
koehleriana, 67, 71, 93, 97, 101, 102.
langeri, 97.
laportaeli, 59.
macmurryi, 66, 69.
meadei, 60, 64, 71, 104.
melchbacheri, 64, 70, 76.
micros, 60, 63, 70, 104.
mimicana, 114.
mirafloza, 64, 70.
mucorea, 65, 69, 89, 90.
mucoreus, 86.
neomexicana, 67, 68, 97, 101.
obtusius, 86, 87.
opacicolis, 67, 68.
parilis, 67, 72, 101.
peninsularis, 67, 68, 77.
pilosipes, 64, 68, 78.
plena, 65, 71.
plenus, 90.
puberulus, 76.
pulcher, 65, 69, 88, 90.
reinhardi, 65, 71, 88.
scoparia, 65, 69, 79, 80.
scuticeps, 68, 72, 94.
senex, 60, 68, 115.
snowi, 63, 68, 114.
tarsalis, 66, 68, 93, 99.
terminalis, 79, 81.
texanus, 86, 87.
texensis, 67, 68, 72, 109.
timida, 60, 63, 69, 114.
timidus, 113.
trochanter, 65, 71.
wickhami, 66, 72.
litorale, Opisthosiphon (*Cubittsiphona*), 199, 208.
littoralis, Stylochopsis, 459.
Stylochus, 459.
lividus, Aphodius, 1, 3, 4, 6.
Aphodius (*Labarrus*), 6.
Aphodius (*Nialis*), 6.
Scarabaeus, 6.
lobatus, Prosthiostomum, 470, 489, 490.
loisona, Halisidota, 503.
lomaensis, Hallotis, 57.
lomara, Halisidota, 503.
longifissa, Mellita, 436, 437.
longirostris, Melanotis caerulescens, 562.
louella, Halisidota, 502.
lowei, Opisthosiphon (*Bermudesstiphona*) *lamellosum*, 172, 173.
Loxia ludoviciana, 577.
lucasense, Opisthosiphon (*Bermudesstiphona*) *detectum*, 191.
lucifer, Annularia (*Blaesospira*) *echinus*, 339, 340.
lucifugus, Cambarus, 389, 398.
Cambarus lucifugus, 387, 389, 393, 394, 397, 398, 399 (fig.), 403 (fig.), 405, 406.
ludoviciana, Hedymeles, 577.
Loxia, 577.
Piranga, 576.
Tanagra, 576.
Lugarenia, 282, 360.
lurida, Cyclostoma, 234.
Parachondria (*Parachondrops*), 231, 234, 236.
Tudora, 234.
luridum, Cyclostoma, 234.
luridus, Aphodius, 6.
luteomargo, Ataenius, 3, 15, 36, 39.
maduyense, Opisthocoeleum (*Opisthocoeleum*) *lamellicostatum*, 142.
mackinlayi, Annularia (*Annularia*), 352, 353.
Cistula, 353.
Cyclostoma, 353.
Tudora (*Tudorellata*), 353.
macmurryi, Listrochelus, 66, 69.
Phyllophaga (*Listrochelus*), 110, 120 (fig.), 127 (fig.).
macta, Annularia (*Annularita*) *majuscula*, 324, 325.
mactum, Cyclostoma, 325.
macularia, Actitis, 536.
Tringa, 536.
maculosa, Eurylepta, 486.
maculosus, Pseudoceros, 485.
magistra, Annularia (*Troschelvindex*) *arangiana*, 333, 334.
magnirostris, Buteo, 532.
magnolia, Dendroica, 568.
Sylvia, 568.
magnum, Opisthocoeleum (*Opisthocoeleum*) *paradoxum*, 135, 136.

- majuscula*, *Annularia* (*Annularita*), 323, 324.
Annularia (*Annularita*) *majuscula*, 324, 325, 326.
majusculum, *Choanopoma*, 325.
Cyclostoma, 325.
manada, *Hallsidota*, 509.
manatiense, *Opisthosiphon* (*Oubitaphona*), 198, 203.
marginatus, *Ectopistes*, 536.
marginella, *Zenaidura macroura*, 536.
marginellus, *Aphodius*, 36.
maricina, *Protoparce*, 497.
martiensis, *Tudora* (*Aguayotudora*) *recta*, 270, 271.
martona, *Hallsidota*, 507.
maximus, *Piculus rubiginosus*, 548.
mayariensis, *Annularia* (*Annularella*), 367, 381.
Annularia (*Annularella*) *mayariensis*, 381, 382.
Parachondria (*Parachondrops*) *chordata*, 237, 238.
Tudora (*Ramsdenia*) *nobilitata*, 259, 261.
mayensis, *Annularia*, 379.
Annularia (*Annularella*), 367, 379.
Tudora (*Tudorellata*), 379.
mayensis, *Parachondria* (*Parachondrops*) *erecta*, 233.
meadei, *Listrochelus*, 60, 64, 71, 104.
Phyllophaga (*Listrochelus*), 105, 121 (fig.), 129 (fig.).
Megaceryle alcyon, 545.
Megarynychus pitangua mexicanus, 551.
melanocyanea, *Cissilopha melanocyanea*, 557, 558.
melanocyaneus, *Garrulus* (*Cyanocorax*), 558.
melanomma, *Hyla*, 47.
melanotis, *Parus*, 558.
Psaltiriparus melanotis, 558.
Melanotis caerulescens, 562.
caerulescens longirostris, 562.
hypoleucus, 562.
Mellita, revision of keyhole urchins, 435.
Mellita, 435, 436, 437, 439, 441, 442, 443.
ampla, 436.
lata, 437, 440, 441.
latiambulacra, 437, 439.
longiflssa, 436, 437.
pentapora, 436.
Mellita quinquesperforata, 435, 436, 439, 440, 441, 442, 444.
quinquesperforata var. *tenuis*, 436, 442.
testudinata, 436, 439.
Melozone biarcuatum, 579.
biarcuatum hartwegi, 580.
meridionalis, *Eustylochus*, 459, 460.
mexicana, *Streptoprocne zonaris*, 540.
mexicanoides, *Colaptes*, 547.
Colaptes mexicanoides, 547.
mexicanus, *Cassidix mexicanus*, 574.
Corvus, 574.
Megarynychus pitangua, 551.
Scaphorhynchus, 551.
Trogon, 544.
Trogon mexicanus, 544.
Mexico, new anuran amphibians from, 43.
miamii, *Ataenius*, 3, 13, 22, 41.
michelbachert, *Listrochelus*, 64, 70, 76.
Phyllophaga (*Listrochelus*), 76, 122 (fig.), 130 (fig.).
Micropodidae, 540.
micros, *Listrochelus*, 60, 63, 70, 104.
Phyllophaga (*Listrochelus*), 104, 129 (fig.).
micrus, *Buteo nitida*, 532.
migratorius, *Turdus*, 562, 563.
militaris, *Pteraster*, 425, 428.
mimetica, *Annularia* (*Chondropomatus*), 333, 385.
mimicana, *Listrochelus*, 114.
Mimidae, 561.
minaensis, *Annularia* (*Annularops*) *attenuata*, 297, 298.
minia, *Annularia* (*Troschelindex*), 327, 336.
minima, *Tyrannula*, 552.
minimus, *Empidonax*, 552.
minium, *Annularia* (*Annularia*), 336.
Choanopoma, 336.
Cyclostoma, 336.
minor, *Caprimulgus*, 540.
Chordeiles, 540.
Myiochanes, 553.
mirafloza, *Listrochelus*, 64, 70.
Phyllophaga (*Listrochelus*), 72, 122 (fig.), 130 (fig.).
mirandensis, *Tudora* (*Ramsdenia*) *nobilitata*, 259, 260.

- mirifica*, *Choanopoma* (Ramsdenia), 260.
 Ramsdenia, 260.
 Tudora (Ramsdenia) nobilitata, 258, 259, 260.
Mirisiphon, 163, 167.
misona, *Halisidota*, 508.
Mitrephanes phaeocercus, 554.
 phaeocercus quercinus, 554.
Mniotilta varia, 567.
Momotidae, 546.
Momotus lessonii, 546.
 lessonii lessonii, 546.
montana, *Diglossa baritula*, 567.
montezuma, *Cacicus*, 575.
 Gymnostinops, 575.
moreleti, *Cyclostoma*, 196.
moreletiana, *Cyclostoma*, 196.
 Opisthosiphon (*Opisthosiphona*), 196.
 Tudora, 196.
moreletianum, *Opisthosiphon* (*Opisthosiphona*), 193, 195, 197.
 Opisthosiphon (*Opisthosiphona*) *moreletianum*, 195, 196.
morenoi, *Annularia* (*Annularodella*), 302, 303.
morsei, *Annularia* (*Annularops*) *attenuata*, 297, 298.
Motacilla caerulea, 564.
 pileolata, 571.
 varia, 567.
 virens, 569.
mucorea, *Listrochelus*, 65, 69, 89, 90.
 Phyllophaga (*Listrochelus*), 86, 125 (fig.).
mucoreus, *Listrochelus*, 86.
murinum, *Opisthosiphon* (*Bermudezsi-
phona*) *detectum*, 191.
Muscicapa belli, 572.
 carolinensis, 561.
 gilva, 566.
 lawrencei, 551.
 rubrifrons, 570.
 solitaria, 566.
mussehli, *Rothschildia*, 499.
mutabilis, *Coronadena*, 450, 451 (fig.).
 Discocelis, 450, 453.
 Polycelis, 450.
Myiarchus tuberculifer lawrencei, 551.
Myloborus miniatus hellmayri, 571.
- Myiochanes minor*, 553.
 pallidiventris, 553.
 pertinax pertinax, 553.
 richardsonii richardsonii, 553.
 richardsonii sordidulus, 554.
Myriotrochus rinkii, 425, 433.
najazaensis, *Annularia* (*Lugarenia*), 360, 362.
 Annularia (*Lugarenia*) *najazaensis*, 362, 363.
 Tudora (*Aguayotudora*) *aguayoi*, 273, 274.
nana, *Annularia* (*Annularops*) *semicana*, 294, 295.
 Rhytidothyra bilabiata, 220, 222.
narcisi, *Annularia* (*Annularita*) *majuscula*, 324.
natensoni, *Annularia* (*Annularia*), 366, 377.
 Annularia (*Annularops*) *sauvallei*, 291, 292.
 Tudora (Ramsdenia), 258, 263.
 Tudora (Ramsdenia) *natensoni*, 263.
nayapana, *Halisidota*, 506.
nebulosa, *Planocera*, 459, 460, 461.
neglecta, *Columbigallina passerina*, 537.
negrosensis, *Annularia* (*Troschelvin-
dex*) *jiguanensis*, 323, 329.
nella, *Halisidota*, 508.
neomezicana, *Listrochelus*, 67, 68, 97, 101.
 Phyllophaga (*Listrochelus*), 101, 119 (fig.), 121 (fig.), 128 (fig.).
nicaraguae, *Dendrortyx leucophrys*, 534.
nigrescens, *Dendroica*, 568.
 Sylvia, 568.
nigricula, *Parachondria* (*Parachondrops*), 231, 239.
nigriculum, *Ctenopoma*, 239.
nigrogularis, *Cyanolyca pumilo*, 558.
nigrolineatus, *Ataenius*, 34.
nigrum, *Thysanozoon*, 484.
nipensis, *Annularia* (*Annularia*), 366, 375.
 Annularia (*Subannularia*) *storchi*, 344, 345.
nobilitata, *Tudora* (Ramsdenia), 258, 259.
 Tudora (Ramsdenia) *nobilitata*, 259, 260.

- nobilitatum, *Ctenopoma*, 259.
Cyclostoma, 259.
Ramsdenia, 259.
- nodiferum, *Ctenopoma*, 151.
Rhytidopoma, 151.
Rhytidopoma honestum, 150, 151.
- nodulatum, *Cyclostoma*, 153.
Rhytidopoma, 149, 152, 153.
Rhytidopoma nodulatum, 153.
- nogales*, *Listrochelus falsa*, 66, 68,
Phyllophaga (Listrochelus) falsa.
 99.
- notabilis, *Seiurus naevius*, 569.
Seiurus noveboracensis, 569.
- notata, *Carduelis*, 578.
notata, *Tudora (Ramsdenia)*, 258, 262.
- notatus, *Spinus notatus*, 578.
- Notiochelidon pileata*, 555.
- Notoplana*, 468, 475.
atomata, 457, 468, 469.
- notulata, *Acerotisa*, 490.
- nubigena, *Certhia familiaris*, 559.
- obesa*, *Tudora (Aguayotudora)*, 266, 275.
- obliterata*, *Annularia (Bermudezia)*,
 356, 358.
- oblongus, *Scarabaeus*, 4.
- obsoleta*, *Annularia (Annularodes)*,
 283, 287.
Annularia (Diplopoma), 315, 320.
- obtectum, *Opisthosiphon (Bermudezsiphona)*, 168, 178.
Opisthosiphon (Bermudezsiphona)
 obtectum, 178, 179, 180.
Opisthosiphon (Opisthosiphon) ob-
 tectum, 179.
- obtectus, *Opisthosiphon (Opisthosiphona)*, 179.
- obturatum, *Opisthosiphon (Bermudezsiphona)*, 168, 176, 177.
Opisthosiphon (Bermudezsiphona)
 obturatum, 176.
Opisthosiphon (Opisthosiphona) ob-
 turatum, 177.
- obturatus, *Opisthosiphon (Opisthosiphona)*, 177.
- obtusus, *Listrochelus*, 86, 87.
- occidentale*, *Rhytidopoma*, 150, 154.
- occidentalis*, *Dendroica*, 569.
Sylvia, 569.
- occultum*, *Opisthocoele (Opisthocoelelops)*, 138, 140.
Opisthosiphon (Opisthosiphona),
 138.
- occultus, *Opisthosiphon (Opisthosiphona)*, 138.
- ochraceiceps, *Hylophilus*, 567.
Hylophilus ochraceiceps, 567.
- oculifera, *Imogene*, 464, 466, 478.
Stylochopiana, 478, 479.
- oculiferus, *Stylochus*, 464, 465 (fig.), 471.
- Oculoplana*, 457, 459.
whartoni, 458.
- Oligoclado*, 487.
floridanus, 483 (fig.), 487.
- olivaceus, *Regulus satrapa*, 565.
- Oncostoma cinereigulare*, 555.
cinereigulare parifica, 555.
- opacicolis, *Listrochelus*, 67, 68.
Phyllophaga (Listrochelus), 92, 120
 (fig.), 128 (fig.).
- Ophiacantha bidentata*, 425, 427.
- Ophiocten sericeum*, 425, 428.
- Ophiopholis aculeata*, 425, 427.
- Ophiura robusta*, 425, 427.
sarsii, 425, 427.
- Ophiuroidea*, 427.
- opisthocoele*, *Opisthocoele (Opisthocoelelops)*, 134, 140.
Opisthocoele, 134, 138.
Opisthocoele, 133, 134, 140.
 (*Opisthocoelelops*) *excurrens*, 138,
 139.
 (*Opisthocoelelops*) *lamellicostatum*,
 141, 142.
 (*Opisthocoelelops*) *lamellicostatum*
lamellicostatum, 142.
 (*Opisthocoelelops*) *lamellicostatum*
mabuyense, 142.
 (*Opisthocoelelops*) *occultum*, 138, 140.
 (*Opisthocoelelops*) *opisthocoele*, 134,
 140.
 (*Opisthocoelelops*) *paradoxum*, 134,
 135.
 (*Opisthocoelelops*) *paradoxum gibbo-*
sum, 135, 136.
 (*Opisthocoelelops*) *paradoxum mag-*
num, 135, 136.
 (*Opisthocoelelops*) *paradoxum para-*
doxum, 135, 136.
 (*Opisthocoelelops*) *simulans*, 137.
Opisthocoelelops, 134, 138.

Opisthosiphon, 133, 134, 162, 218.

agullerianum, 189.

(Bermudezsiphona) agullerianum, 168, 189.*(Bermudezsiphona)* agullerianum agullerianum, 189.

agullerianum holguinense, 190.

(Bermudezsiphona) agullerianum holguinense, 190.

andrewsi, 192.

(Bermudezsiphona) andrewsi, 168, 192.*(Cubitasiphona)* apertum, 199, 212.*(Opisthosiphona)* apertum, 212.*(Opisthosiphona)* apertus, 212.*(Cylindrosiphona)* bacillum, 215.*(Cylindrosiphona)* bacillum bacillum, 215, 216.*(Cylindrosiphona)* bacillum garciai, 215, 216.*(Opisthosiphon)* bahamense, 162.*(Bermudezsiphona)* banaoense, 168, 175.*(Bermudezsiphona)* banaoense banaoense, 175, 176.*(Bermudezsiphona)* banaoense trincherasense, 175, 176.*(Bermudezsiphona)* bermudezi, 168, 192.

berryi, 210.

(Cubitasiphona) berryi, 199, 209, 210.*(Opisthosiphona)* berryi, 210.*(Cubitasiphona)* berryi berryi, 210, 211.*(Opisthosiphona)* berryi semiapertum, 210.*(Opisthosiphona)* berryi semiapertus, 210, 211.*(Cubitasiphona)* berryi transitorium, 210, 211.*(Cubitasiphona)* berryi viguetense, 210.*(Cubitasiphona)* bioscal, 198, 204.*(Opisthosiphona)* bioscal, 204.*(Opisthosiphona)* bioscal bioscal, 204.*(Opisthosiphona)* bioscal tersum, 211.*(Bermudezsiphona)* caguanense, 168, 185.

caroli, 166.

(Solutapex) caroli, 163, 166.*(Opisthosiphon)* *(Cubitasiphona)* claudens, 198, 201.*(Bermudezsiphona)* cucullatum, 168, 169.

cunaguae, 205.

(Cubitasiphona) cunaguae, 199, 205.*(Opisthosiphon)* cunaguae, 205.

dalli, 216.

(Opisthosiphona) dalli, 216.*(Bermudezsiphona)* detectum, 168, 190, 191.*(Opisthosiphon)* detectum, 191.*(Bermudezsiphona)* detectum detectum, 191.*(Bermudezsiphona)* detectum lucasense, 191.*(Bermudezsiphona)* detectum murinum, 191.*(Opisthosiphona)* detectus, 191.*(Cubitasiphona)* deviatum, 199, 213.*(Opisthosiphon)* echinatum, 165.*(Solutapex)* echinatum, 163.*(Bermudezsiphona)* evanidum, 168, 182, 183.*(Bermudezsiphona)* evanidum degeneratum, 183.*(Opisthosiphona)* evanidum degeneratum, 183.*(Bermudezsiphona)* evanidum evanidum, 183.*(Opisthosiphona)* evanidum evanidum, 183.*(Opisthosiphona)* excurrens, 139.*(Bermudezsiphona)* greenfieldi, 168, 171.*(Cubitasiphona)* guanajaense, 198, 202.*(Bermudezsiphona)* insulanum, 168, 180.*(Bermudezsiphona)* insulanum insulanum, 180, 181.*(Bermudezsiphona)* insulanum scopulorum, 180, 181.*(Opisthosiphona)* judacensis, 206.*(Cubitasiphona)* judasense, 199, 206.*(Opisthosiphon)* judasense, 206.*(Opisthosiphon)* lamellicostatum, 142.*(Bermudezsiphona)* lamellosum, 168, 172.*(Bermudezsiphona)* lamellosum lamellosum, 172, 173.

- Opisthosiphon (Bermudezsiphona) lamellosum lowei*, 172, 173.
(Cubitasiphona) litorale, 199, 208.
(Cubitasiphona) manatiense, 198, 203.
(Opisthosiphona) moreletiana, 196.
(Opisthosiphona) moreletianum, 193, 195, 197.
(Opisthosiphona) moreletianum columbense, 195, 196.
(Opisthosiphona) moreletianum moreletianum, 195, 196.
(Bermudezsiphona) obtectum, 168, 178.
(Bermudezsiphona) obtectum guayosense, 178, 180.
(Bermudezsiphona) obtectum obtectum, 178, 179, 180.
(Opisthosiphon) obtectum obtectum, 179.
(Bermudezsiphona) obtectum scibaboense, 178, 179.
(Bermudezsiphona) obtectum tenulcostum, 178, 179.
(Opisthosiphon) obtectum tenulcostum, 179.
(Opisthosiphona) obtectus, 179.
(Bermudezsiphona) obturatum, 168, 176, 177.
(Bermudezsiphona) obturatum obturatum, 177.
(Opisthosiphona) obturatum obturatum, 177.
(Opisthosiphona) obturatum sub-obturatum, 184.
(Bermudezsiphona) obturatum sulcosum, 177.
(Opisthosiphona) obturatus, 177.
(Opisthosiphona) occultum, 138.
(Opisthosiphona) occultus, 138.
(Bermudezsiphona) palmeri, 168, 170.
(Bermudezsiphona) palmeri camajanesense, 170.
(Bermudezsiphona) palmeri palmeri, 170, 171.
(Cubitasiphona) paredonense, 199, 213, 214.
(Cubitasiphona) paredonense escalerense, 214.
(Cubitasiphona) paredonense paredonense, 214.
- Opisthosiphon (Opisthosiphona) paredonense paredonense*, 214.
(Opisthosiphona) paredonense transitorium, 211.
(Opisthosiphona) paredonensis, 214.
(Bermudezsiphona) plateroense, 168, 178.
(Opisthosiphona) plicatum, 193, 196.
(Cubitasiphona) poeyi, 198, 199.
(Bermudezsiphona) prominulum, 168, 174.
(Cubitasiphona) protractum, 198, 200.
(Opisthosiphon) protractum, 200.
(Opisthosiphona) protractus, 200.
(Opisthosiphona) pupoides, 193, 194.
(Opisthosiphona) pupoides bibijaguaense, 194, 195.
(Opisthosiphona) pupoides casa-sense, 194.
(Opisthosiphona) pupoides pupoides, 194.
(Opisthosiphona) pupoides velazquezii, 194.
quesadai, 164.
(Solutapex) quesadai, 163, 164.
(Cubitasiphona) quinti, 198, 202.
rivorum, 166.
sainzi, 163.
(Solutapex) sainzi, 163.
(Bermudezsiphona) salustii, 168, 181.
(Opisthosiphona) salustii, 181.
(Cubitasiphona) sanchezi, 199, 207.
(Mirisiphon) sculptum, 167.
(Opisthosiphon) sculptum, 167.
(Cubitasiphona) sosai, 199, 208.
(Bermudezsiphona) subobtectum, 168, 186, 187.
(Bermudezsiphona) subobtectum guafadanense, 187, 188.
(Bermudezsiphona) subobtectum puntillense, 187.
(Bermudezsiphona) subobtectum quintanense, 187, 188.
(Bermudezsiphona) subobtectum subobtectum, 187.
(Bermudezsiphona) subobturatum, 168, 183, 184.
(Bermudezsiphona) subobturatum subobturatum, 184.

- Opisthosiphon (Bermudezsiphona) sub-obturatorum tinajaense*, 184.
 (Opisthosiphona) subobturatorus, 184.
 (*Cubitasiphona*) tersum, 199, 211. torrei, 185.
 (*Bermudezsiphona*) torrei, 168, 185.
 (Opisthosiphon) torrei, 185.
 (Opisthosiphona) trincherasense, 176.
 (Opisthosiphona) *turiguanoense*, 193, 197.
Opisthosiphona, 163, 193.
Oporornis tolmiei, 570.
organiicola, Annularia (Annularops) semicana, 294, 295.
Oriole, Baltimore, 574.
 Bullock's, 574.
 orchard, 574.
Oriolus spurius, 574.
Ornismya cyanocephalus, 543.
 dupontii, 541.
 rhami, 543.
Osprey, 533.
ottonis, *Rhytidopoma wrightianum*, 153, 157.
Owl, western burrowing, 540.
Oxyechus vociferus vociferus, 535.
Oxyomus (Pleurophorus) gracilis, 25.

pacifica, *Leodia*, 435, 436.
palea, *Haliotis*, 57.
palenquense, *Rhytidopoma nodulatum*, 153, 154.
pallens, Annularia (Annularisca), 345, 350.
pallescens, *Chamaepella passerina* var., 537.
 Columbigallina passerina, 537.
pallidiceps, *Anthoscenus longirostris*, 544.
 Heliomaster, 544.
pallidiventris, *Mylochanes*, 553.
pallidus, *Cambarus*, 387, 389, 394, 395 (fig.)
pallidus, *Cambarus acherontis*, 394.
palmaritensis, *Tudora (Eutudorex) tro-scheli*, 257, 258.
palmeri, *Opisthosiphon (Bermudezsiphona)*, 168, 170.
Opisthosiphon (Bermudezsiphona) palmeri, 170.

palomarensis, Annularia (*Lugarentia*) *najazaensis*, 362, 363.
paluster, *Vireo pallens*, 566.
Pandion halliaetus carolinensis, 533.
Pandionidae, 533.
papposus, *Crossaster*, 430.
Parachondria, 134, 137, 227, 228, 235.
 (Parachondria) abnata, 227, 229.
 abtiana, 231.
 (Parachondrops) abtiana, 231, 235.
 (Parachondrops) campbelli, 231.
 (Parachondrops) chordata, 231, 237.
 (Parachondrops) chordata *baracoensis*, 237, 238.
 (Parachondrops) chordata chordata, 237, 239.
 (Parachondrops) chordata *guan-tanamensis*, 237, 238.
 (Parachondrops) chordata *mayariensis*, 237, 238.
 (Parachondrops) chordata *songoen-sis*, 237, 238, 239.
 (Parachondrops) chordata *tana-mensis*, 237, 238.
 (Parachondrops) daudinoti, 231, 236.
 (Parachondrops) erecta, 231, 232, 233, 236.
 (Parachondrops) erecta erecta, 233, 236.
 (Parachondrops) erecta *mayensis*, 233.
 (Parachondrops) erecta *ramonensis*, 233.
 (Parachondrops) erecta *turquinen-sis*, 233, 234.
fascia, 227.
 (Parachondria) fascia, 227.
 (Parachondrops) jeannereti, 343.
 (Parachondrops) lurida, 231, 234, 236.
 (Parachondrops) nigracula, 231, 239.
 (Parachondria) texta, 227, 228.
 (Parachondrea) texta booneae, 225, 229.
 (Parachondria) texta *portillensis*, 228, 229.
 (Parachondria) texta texta, 228.
 (Parachondrops) wrighti, 231.
Parachondrops, 227, 231, 232.

- paradoxum, *Eutudora* (*Eutodorops*), 136.
Opisthocoeleicum (*Opisthocoelex*), 134, 135.
Opisthocoeleicum (*Opisthocoelex*) paradoxum, 135, 136.
parallelus, *Saprosites*, 11.
paredonense, *Opisthosiphon* (*Oubitasiphona*), 199, 213, 214.
Opisthosiphon (*Oubitasiphona*) paredonense, 214.
Opisthosiphon (*Opisthosiphona*) paredonense, 214.
paredonensis, *Opisthosiphon* (*Opisthosiphona*), 214.
Paridae, 558.
parifica, *Oncostoma cinereigulare*, 555.
parilis, *Listrochelus*, 67, 72, 101.
Phyllophaga (*Listrochelus*), 101, 128 (fig.).
Parus melanotis, 558.
parva, *Annularia* (*Lugarenia*) *lirata*, 363, 364.
parvulus, *Diastictus*, 8.
Pleurophorus, 3, 8.
Psammodius, 8.
parvus, *Conjuguterus*, 470.
Pasalidae, 1.
Passerine *ciris ciris*, 578.
cyanea, 578.
paulus, *Falco sparverius*, 534.
payroli, *Annularia* (*Bermudezia*), 356, 357.
pellucida, *Acerotisa*, 482.
Enantia, 482, 483 (fig.).
peninsularis, *Falco sparverius*, 534.
peninsularis, *Listrochelus*, 67, 68, 77.
Phyllophaga (*Listrochelus*), 77, 120 (fig.).
pentapora, *Mellita*, 436.
peregrina, *Sylvia*, 568.
Vermivora, 568.
peregrinus, *Saprosites*, 10.
perezi, *Annularia* (*Annularodes*), 283, 288.
Annularia (*Annularodes*) *perezi*, 288, 289.
pernigra, *Certhia familiaris*, 559.
perplexa, *Annularia* (*Annularops*), 291, 302.
perplicata, *Annularia* (*Annularia*), 321.
Annularia (*Juannularia*), 320.
perplicatum, *Choanopoma*, 321.
Chondropoma, 321.
Cyclostoma (*Choanopoma*), 320.
personata, *Tityra*, 550.
Tityra semifasciata, 550.
perspectiva, *Tudora* (*Ramsdenia*), 258, 264.
perspectivum, *Ctenopoma*, 264.
Cyclostoma, 264.
Ramsdenia, 264.
Rhytidopoma, 264.
pertinax, *Contopus*, 553.
Myiochanes pertinax, 553.
Pewee, western wood, 553.
phaeocercus, *Mitrephanes*, 554.
phaeonotus, *Junco*, 581.
phalaena, *Falco sparverius*, 534.
Phanaeus, 2.
Phasianidae, 534.
Phyllophaga, 59, 60, 61, 62, 63, 72, 80.
(*Listrochelus*) *arizona*, 112, 123 (fig.).
(*Listrochelus*) *carminator*, 75, 76, 122 (fig.), 130 (fig.).
(*Listrochelus*) *cavata*, 103, 129 (fig.).
(*Listrochelus*) *chapini*, 84, 124 (fig.), 125 (fig.).
(*Listrochelus*) *cochisa*, 105, 129 (fig.).
(*Listrochelus*) *cushmani*, 109.
(*Listrochelus*) *densicollis*, 74, 122 (fig.), 130 (fig.).
(*Listrochelus*) *disparilis*, 81, 118 (fig.), 123 (fig.), 125 (fig.).
(*Listrochelus*) *duncani*, 111, 123 (fig.).
(*Listrochelus*) *falsa*, 97, 119 (fig.), 121 (fig.), 126 (fig.).
(*Listrochelus*) *falsa nogales*, 99.
(*Listrochelus*) *fimbripes*, 95, 120 (fig.), 126 (fig.).
(*Listrochelus*) *flavipennis*, 84, 119 (fig.), 127 (fig.).
(*Listrochelus*) *granti*, 85, 121 (fig.), 122 (fig.), 127 (fig.), 130 (fig.).
(*Listrochelus*) *huachuca*, 82, 124 (fig.), 125 (fig.), 130 (fig.).
(*Listrochelus*) *koehleriana*, 99, 120 (fig.), 128 (fig.).
(*Listrochelus*) *macmurryi*, 110, 120 (fig.), 127 (fig.).

- Phyllophaga (Listrochelus) meadei*, 105, 121 (fig.), 129 (fig.).
(Listrochelus) michelbacheri, 76, 122 (fig.), 130 (fig.).
(Listrochelus) micros, 104, 129 (fig.).
(Listrochelus) mirafloza, 72, 122 (fig.), 130 (fig.).
(Listrochelus) mucorea, 86, 125 (fig.).
(Listrochelus) neomexicana, 101, 119 (fig.), 121 (fig.), 128 (fig.).
(Listrochelus) opacicolis, 92, 120 (fig.), 128 (fig.).
(Listrochelus) parilis, 101, 128 (fig.).
(Listrochelus) peninsularis, 77, 120 (fig.).
(Listrochelus) pilostipes, 76, 128 (fig.).
(Listrochelus) plena, 90, 125 (fig.).
(Listrochelus) pulcher, 88, 125 (fig.).
(Listrochelus) reinhardi, 89, 125 (fig.).
(Listrochelus) scorparia, 80, 119 (fig.), 120 (fig.), 121 (fig.), 124 (fig.).
(Listrochelus) scuticeps, 94, 123 (fig.).
(Listrochelus) senex, 115, 119 (fig.).
(Listrochelus) snowi, 114, 120 (fig.).
(Listrochelus) tarsalis, 93, 119 (fig.), 120 (fig.), 121 (fig.), 126 (fig.).
(Listrochelus) texensis, 106, 127 (fig.).
(Listrochelus) timida, 113, 120 (fig.).
(Listrochelus) trochanter, 78, 119 (fig.), 121 (fig.), 126 (fig.).
(Listrochelus) wickhami, 107, 119 (fig.), 127 (fig.).
- Phylloghagan subgenus *Listrochelus* of United States, 59.
Phytalus, 60, 61, 62.
 chaenobiana, 60, 61.
Playa cayana, 539.
 cayana incincta, 539.
 cayana stirtoni, 539.
 cayana thermophila, 539.
 thermophila, 539.
Picidae, 547.
- picipes*, ? *Ataenius*, 23, 24.
Picolaptes zonatus, 561.
pictus, *Cambarus*, 387, 389, 398, 419, 421 (fig.).
Piculus rubiginosus maximus, 548.
Picus similis, 547.
 varius, 549.
 Pigeon, band-tailed, 536.
pileata, *Atticora*, 555.
 Notiochelidon, 555.
pileolata, *Motacilla*, 571.
 Wilsonia pusilla, 571.
pilosipes, *Listrochelus*, 64, 68, 78.
 Phyllophaga (Listrochelus), 76, 128 (fig.).
pilsbryi, *Annularia (Annularodisca)*, 289.
pilsbryi, *Annularia (Diplopoma)*, 315, 318.
pilsbryi, *Choanopoma*, 289.
 Choanopoma (Annularodes), 289.
pinense, *Rhytidopoma*, 150, 157, 158.
 Rhytidopoma pinense, 158, 159.
Pipilo maculatus repetens, 580.
Pipra linearis, 550.
Pipridae, 550.
Piranga bidentata sanguinolenta, 576.
 ludoviciana, 576.
 rubra rubra, 576.
Pitangus sulphuratus guatemalensis, 561.
Planaria atomata, 468.
Planctoplanella, 479.
 atlantica, 474 (fig.), 479, 480 (fig.).
planilirata, *Haliotis*, 53.
Planocera elliptica, 459, 460.
 inquillina, 476.
 nebulosa, 459, 460, 461.
Planoceridae, 477.
plateroense, *Opisthosiphon (Bermudez-siphona)*, 163, 173.
platycercus, *Selasphorus platycercus*, 542.
plebejus, *Turdus*, 564.
Plehnia, 457.
 arctica, 450.
Plehnidae, 453, 457.
plena, *Listrochelus*, 65, 71.
 Phyllophaga (Listrochelus), 90, 125 (fig.).
plenus, *Listrochelus*, 90.
Pleurophorus, 4, 7, 8, 10.
 batesi, 7, 8.
 caesus, 8.
 parvulus, 3, 8.

- plicata*, Annularia (Annularops), 291, 298.
plicatum, Opisthosiphon (Opisthosiphona), 193, 196.
plumbea, Diglossa, 567.
podiceps, Podilymbus, 528, 529.
Podiceps californicus, 528.
Podilymbus gigas, 525, 528.
 podiceps, 528, 529.
poeyi, Opisthosiphon (*Cubitasiphona*), 198, 199.
polaris, Leptasterias, 425, 431, 432.
Pollometra proluxa, 425, 432.
Polioptila caerulea caerulea, 564.
Polyborus audubonii, 533.
 cheriway audubonii, 533.
Polycelis mutabilis, 450.
 variabilis, 468, 469.
 Polyclad flatworms of the Atlantic coast of the United States and Canada, 449.
Polycladida, 450, 459.
ponderosa, Haliotis, 49, 52.
Popilius disjunctus, 10.
porcatus, Aphodius, 9.
portillensis, Parachondria (Parachondria) *texta*, 228, 229.
postocularis, Chlorospingus, 576.
 Chlorospingus olivaceus, 576.
potamia, Hallsidota, 510.
Poteriocrinus salteri, 514.
prestoni, Annularia (Annularisca), 345, 346.
 Annularia eburnea, 346.
pretrei, Annularia, 341.
 Annularia (Guilaibona), 341.
 Blaisospira, 341.
 Choanopoma, 341.
 Cyclostoma, 341.
Prionites gularis, 546.
procax, Adamsiella (*Cubadamsiella*), 241, 243.
 Cistula, 243.
 Cyclostoma, 243.
prolixa, Pollometra, 425, 432.
prominulum, Opisthosiphon (*Bermudesiphona*), 168, 174.
Prosthlostomidae, 490.
Prosthlostomum, 470, 490.
 gracile, 470.
 lobatum, 470, 489, 490.
Protoparce, 497.
 huascara, 498.
 maricina, 497.
protractum, Opisthosiphon (*Cubitasiphona*), 198, 200.
 Opisthosiphon (*Opisthosiphon*), 200.
protractus, Opisthosiphon (*Opisthosiphona*), 200.
prytherchi, Hymania, 487, 488, 489.
Psaltiriparus melanotis melanotis, 558.
Psammobius, 9.
 cruentus, 9.
Psammodiini, 2.
Psammodius, 3, 9.
 ambiguus, 10.
 bidens, 3, 9.
 cruentus, 10.
 gracilis, 25.
 parvulus, 8.
Psarocolius aeneus, 575.
pseudalata, Annularia (Annularella), 366, 373.
pseudalatum, Annularia (Annularella), 373.
Pseudoceridae, 484.
Pseudoceros, 485.
 maculosus, 485.
pseudolatum, Annularia, 373.
Psittacidae, 537.
Psittacus canicularis, 537.
Pteraster militaris, 425, 428.
pterostomum, Cyclostomum, 225.
puberulus, Listrochelus, 76.
pubescens, Cambarus, 389, 398, 423.
puella, Trogon, 544.
 Trogon collaris, 544.
pulcher, Listrochelus, 65, 69, 88, 90.
 Phyllophaga (Listrochelus), 88, 125 (fig.).
pulcher, Stylochus, 462, 463 (fig.).
pulverulenta, Tudora (*Eutudorea*), 251, 254.
 Tudora (Tudorops), 254.
pulverulentum, Ctenopoma, 254.
 Cyclostoma, 254.
pumilo, Cyanocorax, 557.
 Cyanolyca pumilo, 557.
puntillense, Opisthosiphon (*Bermudesiphona*) *subobtectum*, 187.
pupoides, Cyclostoma, 194.
 Opisthosiphon (*Opisthosiphona*), 193, 194.
pupoides, Opisthosiphon (*Opisthosiphona*) *pupoides*, 194.
pupoides, Tudora, 194.

- putre, *Annularia* (*Annularisca*) *aurelicoma*, 348, 349.
Choanopoma, 349.
Tudora (*Tudorellata*), 349.
Pyrrangia sanguinolenta, 576.
Pyrrigita biarcuata, 579.
- quadridentatus*, *Aphodius*, 3, 4.
quercinus, *Mitrephanes phaeocercus*, 554.
quesadal, *Opisthosiphon*, 164.
Opisthosiphon (*Solutapex*), 163, 164.
quinqüesperforata, *Mellita*, 435, 436, 439, 440, 441, 442, 444.
quintanense, *Opisthosiphon* (*Bermudez-siphona*) *subobtectum*, 187, 188.
quinti, *Opisthosiphon* (*Cubitasiphona*), 198, 202.
- rafaelensis*, *Turdus plebejus*, 564.
ramonensis, *Parachondria* (*Parachondrops*) *erecta*, 233.
Ramphastidae, 547.
ramsdeni, *Annularia*, 355.
Annularia (*Annulæx*), 352, 355.
ramsdeni, *Annularia* (*Diplopoma*), 315, 316.
ramsdeni, *Tudora* (*Tudorellata*), 355.
Ramsdenia, 248, 258, 262.
bufo, 261.
garciana, 247.
mirifica, 260.
nobilitatum, 259.
perspectivum, 264.
semicoronata, 278.
tolleni, 245.
rangelina, *Tudora* (*Tudora*), 280.
Tudora (*Tudorina*), 280.
rangelinum, *Cyclostoma*, 280.
rangelinus, *Colobostylus*, 280.
rathbunae, *Cambarus*, 387, 389, 414, 415 (fig.).
recta, *Tudora* (*Aguayotudora*), 266, 270.
Tudora (*Aguayotudora*) *recta*, 270, 271.
Tudora (*Tudorisca*), 271.
rectus, *Colobostylus*, 271.
Cyclostomus, 271.
Regulidae, 565.
Regulus satrapa aztecus, 565.
satrapa clarus, 566.
satrapa olivaceus, 565.
- reinhardi*, *Listrochelus*, 65, 71, 88.
Phyllophaga (*Listrochelus*), 89, 125 (fig.).
repetens, *Pipilo maculatus*, 580.
restrictus, *Heleodytes zonatus*, 561.
rhami, *Lamprolaima rhami*, 543.
Ornismya, 543.
Rhexia sp., 409.
Rhyparini, 2.
rhyticephala, ? *Auperia*, 37, 38.
Rhytidopoma, 133, 149.
clathratum, 150, 159, 160.
clathratum candelaense, 160, 161.
clathratum clathratum, 160, 161.
clathratum jumaguaense, 160.
coronatum, 149, 151.
hespericum, 150, 161.
honestum, 149, 150, 151.
honestum honestum, 150, 151.
honestum itinerans, 150.
honestum nodiferum, 150, 151.
nodiferum, 151.
nodulatum, 149, 152, 153.
nodulatum anafense, 153, 154.
nodulatum nodulatum, 153.
nodulatum palenquense, 153, 154.
occidentale, 150, 154.
perspectivum, 264.
pinense, 150, 157, 158.
pinense colombense, 158, 159.
pinense ergastulum, 158, 159.
pinense pinense, 158, 159.
pinense rosarioense, 159.
rugulosum, 149, 150, 155.
tollini, 245.
wrightianum, 150, 156.
wrightianum carbrasense, 156, 157.
wrightianum ottonis, 156, 157.
wrightianum wrightianum, 156, 157.
Rhytidopominae, 131, 132, 133.
Rhytidothyra, 134, 218.
bilabiata, 218, 220, 221.
bilabiata aurantiaca, 220, 221.
bilabiata bilabiata, 220, 221.
bilabiata nana, 220, 222.
bilabiata rosacea, 220.
bilabiata rosea, 220.
bilabiata straminea, 220, 222.
richardsonii, *Mylochanes richardsonii*, 553.
Tyrannula, 553.
ridgwayi, *Cyanocitta stelleri*, 556.
rinkii, *Myriotrochus*, 425, 433.

- rivorum, *Opisthosiphon*, 166.
 robusta, *Ophiura*, 425, 427.
rocat, *Annularia* (*Blaesospira*), 333, 340.
 Annularia (*Troschelvindex*), 327, 336.
 Tudora (*Eutudoreæ*), 251, 255.
 roemerii, *Colobostylus*, 368.
 Dinotocrinus, 514, 515, 516, 517.
 Tudora (*Tudorellata*), 368.
 roemerii, *Cyathocrinites*, 514, 515.
 rogersi, *Cambarus*, 410.
 römeri, *Annularia* (*Annularella*), 366, 368.
 Cyclostomus, 368, 372, 373.
 römeri var., *Cyclostomus*, 372.
rosacea, *Rhytidothyra bilabiata*, 220.
rosarioense, *Rhytidopoma pinense*, 159.
rosea, *Haliotis*, 55, 56.
rosea, *Rhytidothyra bilabiata*, 220.
Rothschildia, 499.
 bucaya, 500.
 muschli, 499.
 rotundata, *Tudora* (*Eutudoreæ*), 250, 252.
 Tudora (*Tudorops*), 252.
 rotundatum, *Ctenopoma*, 252.
 Cyclostoma, 252.
 ruber, *Ergaticus*, 571.
 rubicundus, *Turdus assimilis*, 563.
 rubra, *Fringilla*, 576.
 Piranga rubra, 576.
 rubrifrons, *Cardellina*, 570.
 Muscapa, 570.
 rubritorques, *Aratinga holochlora*, 538.
 rufescens, *Haliotis*, 49, 51, 58.
 Haliotis rufescens, 51, 52, 53.
 ruficapilla, *Sylvia*, 568.
 Vermivora ruficapilla, 568.
 ruficauda, *Almophila ruficauda*, 580.
 ruffrons, *Idiotes ruffrons*, 572.
 Setophaga, 572.
 rufitorques, *Turdus*, 563.
 Turdus (*Merula*), 563.
 rufociliatus, *Troglodytes*, 560.
 Troglodytes rufociliatus, 560.
 rufum, *Toxostoma*, 562.
 rugulosum, *Ctenopoma*, 153, 154, 155.
 Cyclostoma, 155.
 Rhytidopoma, 149, 150, 155.
 sabuleti, *Aphodius*, 9.
 sainzi, *Opisthosiphon*, 163.
 Opisthosiphon (*Solutapex*), 163.
 salebrosum, *Cyclostoma*, 221.
 sallael, *Trogon*, 545.
 Trogon violaceus, 545.
 saller, *Aphodius*, 1, 3, 4, 5.
 Aphodius (*Bodilus*), 5.
 Saltator atriceps atriceps, 577.
 salteri, *Dinotocrinus*, 514.
 Poteriocrinus, 514.
 Scaphiocrinus, 514.
 salustii, *Opisthosiphon* (*Bermudezsi-phona*), 168, 181.
 Opisthosiphon (*Opisthosiphona*), 181.
 salvini, *Delattria henrica*, 542.
 Lampornis amethystinus, 542.
sanchezi, *Opisthosiphon* (*Cubitasi-phona*), 199, 207.
 sanctorum, *Dryobates*, 549.
 Dryobates villosus, 549.
 Sandpiper, spotted, 536.
 sanguinolenta, *Henricia*, 425, 428.
 Piranga bidentata, 576.
 Pyranga, 576.
 santacruzii, *Centurus aurifrons*, 548.
 Saproites, 4, 7, 10.
 blackwelderi, 3, 11.
 grenadensis, 3, 11.
 parallelus, 11.
 peregrinus, 10.
 ventralls, 10.
 Sapsucker, yellow-bellied, 549.
 sarsii, *Ophiura*, 425, 427.
 Saturniidae, 499.
Saurophagus guatemalensis, 551.
 sauvallei, *Annularia* (*Annularops*), 290, 291.
 sauvallei, *Annularia* (*Annularops*) sauvallei, 291, 292.
 Choanopoma, 292.
 Saylor, Lawrence W., on scarabaeid beetles of phyllophagan subgenus *Listrochelus* of the United States, 59.
Sayornis aquatica, 552.
 nigricans aquatica, 552.
scabrata, *Limadora*, 245, 247.
Scaphiocrinus huntsvillae, 514, 515.
 salteri, 514.
Scaphorhynchus mexicanus, 551.
Scarabaeidae, 2, 59.
Scarabaeus arenarius, 9.
 caesus, 7.
 elongatus, 26.
 erraticus, 4.

- Scarabaeus fossor*, 4.
lividus, 6.
oblongus, 4.
 Schaus, William, on heterocerous moths in the United States National Museum, 497.
Schematommata, 467.
Scirpus, 525.
scitulus, *Basileuterus belli*, 572, 578.
Scolopax delicata, 536.
Scolopacidae, 536.
scoparia, *Listrochelus*, 65, 69, 79, 80.
 Phyllophaga (*Listrochelus*), 80, 119 (fig.), 120 (fig.), 121 (fig.), 124 (fig.).
scopulorum, *Opisthosiphon* (*Bermudezsi*) *insulanum*, 180, 181.
sculptum, *Ctenopoma*, 167.
 Cyclostoma, 167.
 Opisthosiphon (*Mirisiphon*), 167.
 Opisthosiphon (*Opisthosiphon*), 167.
scutellaris, *Ataenius*, 12.
scuticeps, *Listrochelus*, 68, 72, 94.
 Phyllophaga (*Listrochelus*), 94, 123 (fig.).
seidaboense, *Opisthosiphon* (*Bermudezsi*) *obtectum*, 178, 179.
Seiurus naevius notabilis, 569.
 noveboracensis notabilis, 569.
Selasphorus platycercus platycercus, 542.
 platycercus guatemalae, 542.
semiapertum, *Opisthosiphon* (*Opisthosiphona*) *berryi*, 210.
semiapertus, *Opisthosiphon* (*Opisthosiphona*) *berryi*, 210, 211.
semicana, *Annularia* (*Annularops*), 290, 293, 294.
 Annularia (*Annularops*) *semicana*, 294, 295.
semicoronata, *Ramsdenia*, 278.
 Tudora (*Wrightudora*), 275, 278.
semicoronatum, *Ctenopoma*, 278.
 Cyclostoma, 278.
semiflavus, *Vireo*, 566.
 Vireo pallens, 566.
senex, *Listrochelus*, 60, 68, 115.
 Phyllophaga (*Listrochelus*), 115, 119, (fig.).
septentrionalis, *Ceryle*, 545.
 Chloroceryle americana, 545.
 Zonotrichia capensis, 581.
sericeum, *Ophiocten*, 425, 428.
serripennis, *Stelgidopteryx ruficollis*, 558.
Setophaga guatemalae, 571.
 picta guatemalae, 571.
 rufifrons, 572.
sexiesperforata, *Leodia*, 435.
Sialia sialis guatemalae, 564.
sidanicuensis, *Tudora* (*Aguayotudora*) *bermudezi*, 269, 270.
siegruna, *Hallsidota*, 509.
sifonensi, *Annularia* (*Lugarenia*), 360, 364.
sillaensis, *Limadora garciana*, 246, 247.
similis, *Ceophloeus lineatus*, 547.
 Picus, 547.
simpsoni, *Torrella* (*Torrellisca*), 147, 149.
 Torrella (*Torrellisca*) *simpsoni*, 148.
simulans, *Opisthocoeleum* (*Opisthocoelex*), 137.
smithi, *Syrrophus*, 43.
smithsoni, *Hallotis*, 54.
Snipe, *Wilson's*, 536.
snowi, *Listrochilus*, 63, 68, 114.
 Phyllophaga (*Listrochelus*), 114, 120 (fig.).
soldina, *Hallsidota*, 504.
solitaria, *Muscicapa*, 566.
solitarius, *Vireo solitarius*, 566.
Solutapea, 163.
songoensis, *Annularia* (*Diplopoma*), 315, 319.
 Parachondria (*Parachondrops*) *chordata*, 237, 238, 239.
sordidulus, *Contopus*, 554.
 Myiochanes richardsoni, 554.
sordidum, *Annularia* (*Annularops*), 297.
 Cyclostoma, 296, 297.
 Cyclostoma (*Cyclotus*), 296.
sordidus, *Ataenius*, 21, 22.
sorenseni, *Hallotis*, 49, 50.
sosai, *Opisthosiphon* (*Oubitasiphona*), 199, 208.
sparverius, *Falco*, 533.
 Falco sparverius, 533.
Speotyto cunicularia hypugaea, 540.
Sphingidae, 497.
Sphyrapicus varius varius, 549.
spinifera, *Enantia*, 482, 484.
spinosissimum, *Xenopoma*, 223, 226.

- Spinus atriceps*, 578.
 notatus, 578.
 psaltria colombianus, 578.
 psaltria croceus, 578.
splendens, *Haliotis*, 53.
splendidula, *Haliotis cracherodii*, 55, 56.
sporina, *Halisidota*, 510.
spurca, *Annularia*, 297.
 Annularia (Annularops) coronadoi, 296, 297.
spurius, *Icterus*, 574.
 Oriolus, 574.
squamatus, *Crossaster*, 425, 428.
steinheili, *Ataenius*, 3, 12, 16.
Stelgidopteryx ruficollis fulvipennis, 556.
 ruficollis serripennis, 556.
stenorhynchus, *Aulacorhynchus prasinus*, 547.
Stephanasterias albula, 425, 432.
stirtoni, *Playa cayana*, 539.
storchi, *Annularia (Annularia)*, 344.
 Annularia (Subannularia), 342, 344.
 Annularia (Subannularia) storchi, 344.
 Choanopoma, 344.
straminea, *Rhytidothyra bilabiata*, 220, 222.
strenua, *Aratinga holochlora*, 538.
strenuus, *Conurus holochlorus*, 538.
Streptoprocne zonaris albicincta, 541.
 zonaris mexicana, 540.
strigicauda, *Ataenius*, 3, 14, 81.
Strigidae, 540.
Strix flammea var. *guatemalae*, 540.
 hypugaea, 540.
Strongylocentrotus dröbachiensis, 425, 433.
Stylochidae, 459, 466.
Stylochoplana, 467, 475.
 angusta, 461, 467.
 floridana, 478, 479.
 oculifera, 478, 479.
Stylochopsis littoralis, 459.
 zebra, 462.
Stylochus, 459, 460, 464, 468.
 crassus, 491.
 ellipticus, 465 (fig.), 459, 460, 461.
 floridanus, 464, 466.
 frontalis, 461, 468.
 Stylochus inimicus, 461, 462, 468.
 littoralis, 459.
 oculiferus, 464, 465 (fig.), 471 (fig.).
 pulcher, 462, 463 (fig.).
 tenax, 461, 462.
 zebra, 462, 464.
Stylostomum, 490.
suavina, *Halisidota*, 510.
suavis, *Tudora (Aguayotudora)*, 266, 267.
Subannularia, 282, 342.
subobscurus, *Basileuterus belli*, 573.
subobtectum, *Opisthosiphon (Bermudezsiphona)*, 163, 186, 187.
 Opisthosiphon (Bermudezsiphona) subobtectum, 187.
subobturatum, *Opisthosiphon (Bermudezsiphona)*, 168, 183, 184.
 Opisthosiphon (Opisthosiphona) obturatum, 184.
 Opisthosiphon (Bermudezsiphona) subobturatum, 184.
subobturatus, *Opisthosiphon (Opisthosiphona)*, 184.
subopacus, *Ataenius*, 3, 14, 18, 24.
sulcatula, *Auperia*, 37.
sulcatulus, *Ataenius*, 3, 15, 37, 41.
sulcicollis, *Aphodius*, 9.
sulcirostris, *Crotophaga*, 539.
 Crotophaga sulcirostris, 539.
sulcosum, *Opisthosiphon (Bermudezsiphona) obturatum*, 177.
sundevalli, *Amphipura*, 425, 427.
supercilliosa, *Vermivora supercilliosa*, 568.
 supercilliosum, *Controstrum*, 568.
Swallow, barn, 556.
Sylvia magnolia, 568.
 nigrescens, 568.
 occidentalis, 569.
 peregrina, 568.
 ruficapilla, 568.
 tolmiei, 570.
 townsendi, 569.
Sylviidae, 654.
Syrrhophus, 43.
 guttulatus, 45.
 smithi, 43.
taorensis, *Annularia (Annularisca)*, 345, 351.
Tanager, summer, 576.
 western, 576.

- Tanagra abbas*, 576.
 (*Saltator*) *atriceps*, 577.
 cyanea, 578.
 elegantissima, 577.
 elegantissima vincens, 577.
 ludoviciana, 576.
tanamensis, *Annularia* (*Annularella*), 366, 375.
 Annularia (*Diplopoma*) *architectonica*, 317, 318.
 Parachondria (*Parachondrops*) *chordata*, 237, 238.
Tangavius aeneus aeneus, 575.
 involucratus, 575.
tarsalis, *Listrochelus*, 66, 68, 93, 99.
 Phyllophaga (*Listrochelus*), 93, 119 (fig.), 120 (fig.), 121 (fig.), 126 (fig.).
Taylor, Edward H., on new anuran amphibians from Mexico, 43.
tenax, *Stylochus*, 461, 462.
tenebrosus, *Ataenius*, 3, 13, 23.
 Opisthosiphon (*Bermudezsiphona*) *obtectum*, 178, 179.
tenulcostum, *Opisthosiphon* (*Opisthosiphon*) *obtectum*, 179.
tenuis, *Mellita* *quinquesperforata* var., 436, 442.
Tergipes brocchi, 485.
terminalis, *Ataenius*, 3, 13, 36, 38.
 Auparia, 38.
 Listrochelus, 79, 81.
ternata, *Annularia* (*Eutodora*) *limbifera*, 305.
ternatum, *Chondropoma*, 305.
terneroensis, *Annularia* (*Annularodes*), 283, 284.
 Annularia (*Annularodes*) *terneroensis*, 285.
 Torrella (*Torrellisca*) *simpsoni*, 148.
terola, *Halisidota*, 502.
tersum, *Opisthosiphon* (*Cubitastiphona*), 199, 211.
 Opisthosiphon (*Opisthosiphona*) *bioscai*, 211.
testudinata, *Mellita*, 436, 439.
texanus, *Listrochelus*, 86, 87.
tezensis, *Listrochelus*, 67, 68, 72, 109.
 Phyllophaga (*Listrochelus*), 106, 127 (fig.).
texta, *Parachondria* (*Parachondria*), 227, 228.
texta, *Parachondria* (*Parachondria*) *texta*, 228.
textum, *Chondropoma*, 228.
 Chondropoma (*Chondropomorus*), 228.
 Cyclostoma, 228.
Thais floridana floridana, 477.
thaisana, *Hoploplana*, 477.
 Hoploplana *inquillina*, 477.
thalassinus, *Collibri*, 543.
 Trochilus, 543.
thermophila, *Playa*, 539.
 Playa cayana, 539.
Thraupidae, 576.
Thraupis abbas, 576.
Thripobrotus compressus, 549.
Thrush, Audubon's hermit, 564.
Thysanozoon, 484, 485.
 brocchi, 485.
 nigrum, 484.
Tilmatura dupontii dupontii, 541.
 dupontii xenoura, 542.
timida, *Listrochelus*, 60, 63, 69, 114.
 Phyllophaga (*Listrochelus*), 113, 120 (fig.).
timidus, *Listrochelus*, 113.
tinajaense, *Opisthosiphon* (*Bermudezsiphona*) *subobturatum*, 184.
Tityra personata, 550.
 semifasciata personata, 550.
Todiostrom cinereigrulare, 555.
toledana, *Halisidota*, 507.
tolleni, *Ramsdenia*, 245.
tollini, *Limadora*, 245.
 Rhytidopoma, 245.
tolmiei, *Opornis*, 570.
 Sylvia, 570.
toroensis, *Annularia* (*Annularella*), 367, 378.
torquata, *Ctenopoma*, 249.
 Cyclostoma, 249.
 Eutodora (*Eutodorops*), 249.
 Tudora (*Eutodorops*), 249.
Torre, Carlos de la, and Paul Bartsch, on Cuban operculate mollusks of family *Annulariidae* (excluding subfamily *Chondropominae*), 131.
torrei, *Annularia* (*Diplopoma*), 315.
 Diplopoma, 315.
 Opisthosiphon, 185.
 Opisthosiphon (*Bermudezsiphona*), 168, 185.
 Opisthosiphon (*Opisthosiphon*), 185.

- torrelana, *Torrella* (*Torrella*), 143.
torrelianum, *Ctenopoma*, 143.
Torrella, 133, 143, 148.
 (*Torrella*) *deficiens*, 143, 144.
 (*Torrella*) *immersa*, 143, 145, 146.
 (*Torrella*) *immersa camaronensis*, 146, 147.
 (*Torrella*) *immersa grillensis*, 146, 147.
 (*Torrella*) *immersa immersa*, 146.
 (*Torrellisca*) *simpsoni*, 147, 149.
 (*Torrellisca*) *simpsoni simpsoni*, 148.
 (*Torrellisca*) *simpsoni terneroensis*, 148.
 (*Torrella*) *torreliana*, 143.
 (*Torrellisca*) *trinidadiansis*, 147, 148.
Torrellisca, 143, 147.
townsendi, *Dendroica*, 569.
 Sylvia, 569.
Toxostoma rufum, 562.
tracta, *Annularia* (*Annularia*), 327.
 Annularia (*Troschelindex*), 327.
tractum, *Choanopoma*, 327.
 Cyclostoma, 327.
transitoria, *Annularia* (*Eutudora*), 304, 306, 307.
 Annularia (*Eutudora*) *transitoria*, 307, 308.
transitorium, *Opisthosiphon* (*Cubitasiphona*) *berryi*, 210, 211.
transitorium, *Opisthosiphon* (*Opisthosiphona*) *paredonense*, 211.
Trigonoporus dendriticus, 454, 456.
 folium, 454, 456, 457.
trincherasense, *Opisthosiphon* (*Bermudezsiphona*) *banaoense*, 175, 176.
trincherasense, *Opisthosiphon* (*Opisthosiphona*), 176.
Tringa macularia, 536.
trinidadiansis, *Torrella* (*Torrellisca*), 147, 148.
Tripylocells, 475.
trochanter, *Listrochelus*, 65, 71.
 Phyllophaga (*Listrochelus*), 78, 119 (fig.), 121 (fig.), 126 (fig.).
Trochilidae, 541.
Trochilus colubris, 542.
 enicurus, 541.
 leucotis, 543.
 thalassinus, 543.
Troglodytes musculus intermedius, 559.
 rufociliatus, 560.
 rufociliatus rufociliatus, 560.
Troglodytidae, 559.
Trogon collaris, 544.
 collaris puella, 544.
 mexicanus, 544.
 mexicanus mexicanus, 544.
 puella, 544.
 sallaei, 545.
 violaceus sallaei, 545.
Trogonidae, 544.
Tropic-bird, yellow-billed, 530.
Troscheli, *Choanopoma*, 257.
 Cyclostoma, 257.
Tudora (*Eutudora*), 251, 256, 257.
 Tudora (*Tudorops*), 257.
 Tudora (*Eutudora*) *troscheli*, 257.
Troschelindex, 282, 326, 327.
 candeanum, 331.
 illustis, 331.
tryoni, *Annularia* (*Annularops*), 291, 300.
 Annularia (*Annularops*) *tryoni*, 301.
 Choanopoma, 301.
 Ctenopoma, 301.
tuberculata, *Tudora* (*Aguayotudora*), 266, 272.
Tudora, 244, 248, 249, 280.
 abtiana, 235.
 (*Aguayotudora*) *aguayoi*, 266, 273.
 (*Aguayotudora*) *aguayoi aguayoi*, 273.
 (*Aguayotudora*) *aguayoi guaicana-amarensis*, 273, 274.
 (*Aguayotudora*) *aguayoi najazensis*, 273, 274.
 ? *agulleriana*, 189.
 (*Tudorellata*) *alatum*, 351.
 (*Wrighttadora*) *arcticoronata*, 275, 276.
 (*Aguayotudora*) *asperata*, 266, 272.
 (*Tudorellata*) *auricoma*, 348.
 (*Aguayotudora*) *bermudezi*, 266, 269.
 (*Aguayotudora*) *bermudezi bermudezi*, 269, 270.
 (*Aguayotoudora*) *bermudezi sibanicuensis*, 269, 270.
 (*Ramsdenia*) *bufo*, 258, 261.
 (*Eutudorisca*) *catenata*, 314.
 (*Eutudoreæ*) *complanata*, 251, 255.

- Tudora (Aguayotudora) crassiuscula*, 266, 268.
(Aguayotudora) cristata, 266, 267, 268.
(Aguayotudora) cristata chor-rillensis, 268.
(Aguayotudora) cristata cristata, 268.
(Tudorellata) cumulata, 369.
(Gundlachtudora) decolorata, 265.
(Tudorellata) decolorata, 265.
(Wrightudora) enode, 275, 276.
excurrens, 139.
(Wrightudora) garridolana, 275, 279.
(Wrightudora) garridolana baracoensis, 279.
(Wrightudora) garridolana garri-dolana, 279, 280.
(Wrightudora) gundlachi, 275, 277.
(Tudorellata) heynemanni, 371.
(Tudorellata) interstitialis, 377.
lurida, 234.
(Tudorellata) mackinlayi, 353.
(Tudorellata) mayensis, 379.
moreletiana, 196.
(Ramsdenia) natensoni, 258, 263.
Ramsdenia natensoni canetensis, 263, 264.
(Ramsdenia) natensoni natensoni, 263.
(Ramsdenia) nobilitata, 258, 259.
(Ramsdenia) nobilitata mayariensis, 259, 261.
(Ramsdenia) nobilitata mirandensis, 259, 260.
(Ramsdenia) nobilitata mirifica, 258, 259, 260.
(Ramsdenia) nobilitata nobilitata, 259, 260.
(Ramsdenia) nobilitata yaterasensis, 259, 261.
(Ramsdenia) notata, 258, 262.
(Aguayotudora) obesa, 266, 275.
(Ramsdenia) perspectiva, 258, 264.
(Eutudorex) pulverulenta, 251, 254.
(Tudorops) pulverulenta, 254.
pupoides, 194.
(Tudorellata) putre, 349.
(Tudorellata) ramsdeni, 355.
(Tudora) rangelina, 280.
(Tudorina) rangelina, 280.
(Aguayotudora) recta, 266, 270.
- Tudora (Tudorisca) recta*, 271.
(Aguayotudora) recta barretti, 270, 271.
(Aguayotudora) recta martiensis, 270, 271.
(Aguayotudora) recta recta, 270, 271.
(Eutudorex) rocai, 251, 255.
(Tudorellata) roemerii, 368.
(Eutudorex) rotundata, 250, 252.
(Tudorops) rotundata, 252.
(Wrightudora) semicoronata, 275, 278.
(Aguayotudora) suavis, 266, 267.
(Eutudorex) troscheli, 251, 256, 257.
(Tudorops) troscheli, 257.
(Eutudorex) troscheli antontensis, 257.
(Eutudorex) troscheli azucarensis, 257, 258.
(Eutudorex) troscheli palmaritensis, 257, 258.
(Eutudorops) torquata, 249.
(Eutudorex) troscheli troscheli, 257.
(Aguayotudora) tuberculata, 266, 272.
(Eutudorex) undosa, 251, 252, 253.
(Tudorops) undosa, 254.
(Eutudorex) undosa barroi, 253.
(Eutudorex) undosa laureani, 253.
(Eutudorex) undosa undosa, 254.
(Aguayotudora) varicosa, 266, 274.
(Eutudorex) welchi, 250, 251.
wrighti, 231.
(Tudorellata) yateracensis, 370.
- Tudorellata*, 366.
Tudorina, 248, 280.
tumulosa, Chlaenobia, 60, 61.
Turbo lincina, 281.
Turdidae, 562.
Turdus assimilis rubicundus, 563.
auduboni, 564.
grayi grayi, 563.
grayi umbrinus, 563.
ignobilis, 564.
migratorius, 562, 563.
plebejus, 564.
plebejus differens, 563.
plebejus rafaelsensis, 564.
rufitorques, 563.
(Merula) rufitorques, 563.

- turiguanense*, *Opisthosiphon* (*Opisthosiphona*), 193, 197.
turquinensis, *Parachondria* (*Parachondrops*) *erecta*, 233, 234.
Tyrannidae, 551.
Tyranniscus vilissimus vilissimus, 554.
Tyrannula affinis, 552.
 hammondii, 552.
 minima, 552.
 richardsonii, 553.
Tyrannus verticalis, 551.
 vociferans, 551.
Tyto perlata guatemalae, 540.
Tytonidae, 540.

umbrinus, *Turdus grayi*, 563.
uncinata, *Annularia* (*Annularodes*), 282, 283, 284.
uncinatum, *Choanopoma*, 283.
undosa, *Tudora* (*Eutudorex*), 251, 252, 253.
 Tudora (*Tudorops*), 254.
 Tudora (*Eutudorex*) *undosa*, 254.
undosum, *Ctenopoma*, 254.
 Cyclostoma, 254.
untuberculata, *Chlaenobia*, 61.

vannostrandii, *Annularia* (*Annularops*), 290, 293.
 Cyclostoma (*Ctenopoma*), 293.
varia, *Mniotilta*, 567.
 Motacilla, 567.
variabilis, *Leptoplanea*, 468, 469.
 Polycella, 468, 469.
varicosa, *Tudora* (*Agayotudora*), 266, 274.
varius, *Picus*, 549.
 Sphyrapicus varius, 549.
velazquezii, *Opisthosiphon* (*Opisthosiphona*) *pupoides*, 194.
velox, *Accipiter striatus*, 532.
 Falco, 532.
ventralis, *Saprosites*, 10.
Vermivora peregrina, 568.
 ruficapilla ruficapilla, 568.
 supercilliosa supercilliosa, 568.
verrilli, *Gnesioceros*, 478.
versicolor, *Ataenius*, 3, 14, 35, 36.
 Cardellina, 570.
 Ergaticus, 570.
verticalis, *Tyrannus*, 551.
vexata, *Chlaenobia*, 61.

victoriae, *Annularia* (*Annularella*), 366, 369.
viguettense, *Opisthosiphon* (*Cubitastiphona*) *berryi*, 210.
vilissimus, *Tyranniscus vilissimus*, 554.
vinalenis, *Annularia* (*Annularops*) *tryoni*, 301.
vincens, *Tanagra elegantissima*, 577.
vincentiae, *Ataenius*, 3, 13, 19.
virens, *Dendroica virens*, 569.
 Motacilla, 569.
Vireo, blue-headed, 566.
 eastern warbler, 566.
 yellow-throated, 566.
Vireo flavifrons, 566.
 gilvus gilvus, 566.
 huttoni vulcani, 565.
 pallens paluster, 566.
 pallens semiflavus, 566.
 semiflavus, 566.
 solitarius solitarius, 566.
Vireonidae, 565.
virilis, *Leptoplanea*, 468, 469.
vociferans, *Tyrannus*, 551.
vociferus, *Charadrius*, 535.
 Oxyechus vociferus, 535.
vulcani, *Vireo huttoni*, 565.
vulneratus, *Diastictus*, 8.

walallensis, *Haliotis*, 49, 51.
 Haliotis fulgens, 51.
 Haliotis rufescens, 51, 52.
waltherhorni, *Ataenius*, 41.
Warbler, black and white, 567.
 black-throated gray, 568.
 black-throated green, 569.
 hermit, 569.
 MacGillivray's, 570.
 magnolia, 568.
 Nashville, 568.
 northern pileolated, 571.
 red-faced, 570.
 Tennessee, 568.
 Townsend's, 569.
welchi, *Annularia* (*Annularella*) *maya-riensis*, 381.
 Tudora (*Eutudorex*), 250, 251.
West Indian beetles of scarabaeid subfamily Aphodiinae, 1.
Wetmore, Alexander, on birds of the Guatemalan highlands, 523.
whartoni, *Latocestus*, 455 (fig.), 458.
 Oculoplanea, 458.

- wickhami*, *Listrochelus*, 66, 72.
Phyllophaga (*Listrochelus*), 107,
 119 (fig.), 127 (fig.).
Wilsonia pusilla pileolata, 571.
Woodocrinus, 514, 515.
wrightii, *Annularia* (*Annularella*), 367,
 380.
wrightii, *Parachondria* (*Parachon-*
drops), 231.
Tudora, 231.
wrightianum, *Rhytidopoma*, 150, 156.
Rhytidopoma wrightianum, 156,
 157.
Wrightudora, 248, 275.

Xanthornus bullockii, 574.
Xenopoma, 134, 218, 222, 224.
aguayoi, 223, 224.
hendersoni, 223, 225, 226, 227.
humboldtiana, 223.
humboldtianum, 223.
hystrix, 223, 225, 227.
spinosissimum, 223, 226.
Xenopomoides, 134, 217.
delicatulum, 217.
xenoura, *Tilmatura dupontii*, 542.
Xylophanes, 490.
cantel, 490.
katherinae, 490.

yateracensis, *Tudora* (*Tudorellata*),
 370.
yaterasense, *Choanopoma*, 370.
Cyclostoma, 370.
yaterasensis, *Annularia* (*Annularella*),
 366, 370.
yaterasensis, *Tudora* (*Ramsdenia*) *no-*
bilitata, 259, 261.
yumuriensis, *Annularia* (*Annularella*),
 366, 374.
yunquense, *Choanopoma*, 370.
Cyclostoma, 379.
yunquensis, *Annularia* (*Annularella*),
 366, 367, 379.

zacualpana, *Hallsidota*, 501.
Zeacrinus, 515.
zebra, *Stylochopsis*, 462?
Stylochus, 462, 464.
Zenaida asiatica asiatica, 537.
Zenaidura macroura marginella, 536.
Zimmerman, Elwood C., on *Eurhop-*
todes, a remarkable new genus of
 Philippine cryptorhynchine weevils,
 445.
zonatus, *Picolaptes*, 561.
Helcodytes zonatus, 561.
Zonotrichia capensis septentrionalis,
 581.

INDEX

- aberrans, *Annularia*, 345, 347.
 abnata, *Parachondria*, 227, 229.
 abnatum, *Chondropoma*, 229.
 abnatum, *Cyclostoma*, 229.
 abtiana, *Parachondria*, 231, 235.
 abtiana, *Tudora*, 235.
 acervata, *Annularia*, 296, 297.
 acervatum, *Choanopoma*, 296.
 Adamsiella, 240, 241.
 chordatum, 239.
 gratiosa, 241.
 leoni, 241, 242.
 procax, 241, 243.
 Adamsiellinae, 131, 132, 240.
 Adamsiellops, 241.
 agassizi, *Annularia*, 310, 312.
 agassizi, *Chondropoma*, 312.
 agassizii, *Cistula*, 312.
 agassizii, *Cyclostoma*, 312.
 agassizii, *Eutudora*, 312.
 agrestis, *Annularia*, 327, 337.
 agrestis, *Cistula*, 337.
 aguayoi, *Tudora*, 266, 273.
 aguayoi, *Xenopoma*, 223, 224.
 Aguayotudora, 248, 266.
 aguileriana, *Tudora*, 189.
 aguilerianum, *Cyclostoma*, 189.
 aguilerianum, *Opisthosiphon*, 168, 189.
 alata, *Annularia*, 345, 350, 351.
 alatum, *Choanopoma*, 350, 351, 373.
 alatum, *Cistula*, 373.
 alatum, *Cyclostoma*, 350.
 alatum, *Tudora*, 351.
 anafense, *Rhytidopoma*, 153, 154.
 andrewsi, *Opisthosiphon*, 168, 192.
 Annularella, 282, 352, 366, 383.
 Annularet, 282, 352.
 Annularia, 244, 281, 383.
 aberrans, 345, 347.
 acervata, 296, 297.
 agassizi, 310, 312.
 agrestis, 327, 337.
 alata, 345, 350, 351.
 a'angiana, 327, 332, 333.
 architectonica, 314, 315, 317.
 arguta, 320, 321, 322.
 arquesi, 366, 372.
 attenuata, 290, 297, 298.
 auricoma, 345, 347, 348, 349, 351.
 bairiensis, 328, 329.
 barbouri, 327, 335.
 bebini, 327, 334.
 bermudezi, 356.
 biayensis, 360, 361.
 blaini, 290, 291, 299, 300.
 blanesi, 313, 314.
 boqueronensis, 309.
 Annularia cabrerai, 304.
 camoensis, 310, 312.
 canapuensis, 381, 382.
 candeana, 326, 327, 330, 331.
 canoensis, 283, 284.
 cantarillensis, 283, 285.
 capestanyi, 356, 358.
 catalinensis, 324, 326.
 catenata, 310, 313, 314.
 cautoensis, 333.
 chorrerensis, 291, 292.
 chorrillensis, 361.
 coronadoi, 290, 295, 296.
 cortinai, 291.
 crassilabris, 324, 325.
 cumbrensis, 299, 300, 324.
 cumulata, 366, 369.
 distincta, 307, 308.
 eburnea, 345.
 echinus, 338, 339.
 euglypta, 356, 359.
 eurystoma, 360, 361.
 excelsa, 324, 326.
 fallax, 330, 331.
 fragilis, 364, 365, 366.
 guitarti, 288, 289.
 hendersoni, 366, 367.
 heynemania, 371.
 heynemanni, 366, 371.
 holguinensis, 366, 373.
 illustris, 330, 331.
 incerta, 352, 354.
 inculta, 327, 331, 332.
 indioensis, 285.
 indivisa, 283, 286.
 infernalis, 339, 340.
 inquisita, 309.
 insularis, 322.
 intercisa, 352.
 interstitialis, 366, 377.
 jeannereti, 342, 343.
 jiguanensis, 327, 328, 329.
 jimenoi, 310, 311.
 juliani, 365.
 lachneri, 342.
 lata, 383, 384.
 latistoma, 304, 308.
 libanoensis, 317, 318, 366, 376.
 limbifera, 303, 304, 305, 306, 308.
 lirata, 360, 363, 364.
 lucifer, 339, 340.
 mackinlayi, 352, 353.
 macta, 324, 325.
 magistra, 333, 334.
 majuscula, 323, 324, 325, 326.
 mayariensis, 367, 381, 382.
 mayensis, 367, 379.

- Annularia mimetica*, 383, 385.
minaensis, 287, 298.
minia, 327, 336.
minium, 336.
morenoi, 302, 303.
morsei, 297, 298.
najazaensis, 360, 362, 363.
nana, 294, 295.
narcisi, 324, 325.
natensoni, 291, 292, 366, 377.
negrosensis, 328, 329.
nipensis, 344, 345, 366, 375.
obliterata, 356, 358.
obsoleta, 283, 287, 315, 320.
organicola, 294, 295.
pallens, 345, 350.
palomarensis, 362, 363.
parva, 363, 364.
payroli, 356, 357.
perezi, 283, 288, 289.
perplexa, 291, 302.
perplicata, 320, 321.
pilsbryi, 289, 315, 318.
plicata, 291, 298.
prestoni, 345, 346.
pretrei, 341.
pseudalata, 366, 373.
pseudalatum, 373.
pseudolatum, 373.
putre, 348, 349.
ramsdeni, 315, 316, 352, 355.
rocali, 327, 336, 338, 340.
römeri, 368.
sauvallei, 290, 291, 292.
semicana, 290, 293, 294, 295.
sifontesi, 360, 365.
songoensis, 315, 319.
sordidum, 297.
spurca, 296, 297.
storchii, 342, 344.
tacrensis, 345, 351.
tanamensis, 317, 318, 366, 375.
ternata, 305, 306.
terneroensis, 283, 284, 285, 287.
toroensis, 367, 378.
torrei, 315.
tracta, 327.
transitoria, 304, 306, 307, 308.
tryoni, 291, 300.
uncinata, 282, 283, 284.
vannostrandii, 290, 293.
victoris, 366, 369.
vinalensis, 300, 301.
welchi, 381.
wrighti, 367, 380.
yaterasensis, 366, 370.
yumuriensis, 366, 374.
yunquensis, 366, 367, 379.
- Annulariidae*, 131.
Annulariinae, 131, 132, 244.
Annularisca, 282, 345.
Annularita, 282, 323.
Annularodella, 281, 302.
Annularodes, 281, 282, 288, 289, 302.
Annularodisca, 281, 289.
Annularops, 281, 290, 302.
Annularosa, 282, 364.
antoniensis, Tudora, 257.
apertum, Opisthosiphon, 199, 212.
apertus, Opisthosiphon, 212.
arangiana, Annularia, 327, 332, 333.
arangianum, Choanopoma, 333.
arangianum, Cyclostoma, 333.
architectonica, Annularia, 314, 315, 317.
architectonicum, Cyclostoma, 317.
architectonicum, Diplopoma, 317, 318.
arcticoronata, Tudora, 275, 276.
arguta, Annularia, 320, 321, 322.
argutum, Chondropoma, 322.
argutum, Ctenopoma, 322.
arquesi, Annularia, 366, 372.
arquesi, Colobostylus, 372.
arquesi, Cyclostoma, 372.
asperata, Tudora, 266, 272.
attenuata, Annularia, 290, 297.
aurantiaca, Rhytidothyra, 220, 221.
auricoma, Annularia, 345, 347, 348, 349, 351.
auricoma, Tudora, 348.
auricomum, Choanopoma, 348.
auricomum, Cyclostoma, 348.
azucarensis, Tudora, 257.
- bacillum*, Opisthosiphon, 215, 216.
bahamense, Opisthosiphon, 162.
bairensis, Annularia, 328, 329.
banaoense, Opisthosiphon, 168, 175, 176.
baracoensis, Parachondria, 237, 238.
baracoensis, Tudora, 279.
barbouri, Annularia, 327, 335.
barreta, Tudora, 270, 271.
barroi, Tudora, 253.
bebini, Annularia, 327, 334.
bebini, Choanopoma, 334.
bermudezi, Annularia, 356.
bermudezi, Opisthosiphon, 168, 192.
bermudezi, Tudora, 266, 269, 270.
Bermudezia, 282, 356.
Bermudezsi, 163, 168.
berryi, Opisthosiphon, 199, 209, 210.
biayensis, Annularia, 360, 361.
bibijaguaense, Opisthosiphon, 194, 195.
bilabiata, Cistula, 221.
bilabiata, Cyclostoma, 221.
bilabiata, Rhytidothyra, 218, 220, 221.
bilabiatum, Chondropoma, 221.
bilabiatum, Ctenopoma, 221.
bioscai, Opisthosiphon, 198, 204.
Blaesospira, 282, 338, 341.
echinus, 338, 339.
pretrei, 341.
blaini, Annularia, 290, 291, 299, 300.
blaini, Choanopoma, 300.
blanesi, Annularia, 313, 314.
booneae, Chondropoma, 229.
booneae, Parachondria, 228, 229.
boqueronensis, Annularia, 309.
bufo, Ctenopoma, 261.
bufo, Cyclostoma, 261.
bufo, Ramsdenia, 261.
bufo, Tudora, 258, 261.
- cabrasense*, Rhytidopoma, 156, 157.
cabrerai, Annularia, 304.
caguanense, Opisthosiphon, 168, 185.

- camajanense*, *Opisthosiphon*, 170, 171.
camaronensis, *Torrella*, 146, 147.
camoensis, *Annularia*, 310, 312.
campbelli, *Parachondria*, 231.
canapuensis, *Annularia*, 381, 382.
candeana, *Annularia*, 326, 327, 330, 331.
candeana, *Cistula*, 331.
candeanum, *Cistula*, 331.
candeanum, *Cyclostoma*, 331.
candeanum, *Troschelvindex*, 331.
candelaense, *Rhytidopoma*, 160, 161.
canetensis, *Tudora*, 263, 264.
canoaensis, *Annularia*, 283, 284.
cantarillensis, *Annularia*, 283, 285.
capestanyi, *Annularia*, 356, 358.
caroli, *Opisthosiphon*, 163, 166.
casasense, *Opisthosiphon*, 194.
catalinensis, *Annularia*, 324, 326.
catenata, *Annularia*, 310, 313, 314.
catenata, *Cistula*, 306.
cautoensis, *Annularia*, 333.
Choanopoma acervatum, 296.
 alatum, 350, 351, 373.
 arangianum, 333.
 auricomum, 348.
 bebini, 334.
 bibabiatum, 221.
 blaini, 300.
 daudinoti, 236.
 decolorata, 265.
 eburneum, 345.
 echinus, 339.
 fragile, 365.
 humboldtianum, 223.
 hystrix, 225.
 indivisum, 286.
 inquisita, 309.
 jiguanense, 329.
 lachneri, 342.
 majusculum, 325.
 minium, 336.
 mirifica, 260.
 perplicatum, 321.
 pilsbryi, 289.
 pretrei, 341.
 putre, 349.
 sauvallei, 292.
 storchi, 344.
 tractum, 327.
 troscheli, 257.
 tryoni, 301.
 uncinatum, 283.
 yaterasense, 370.
 yunquense, 379.
Chondropoma, 228, 235, 383.
 abnatum, 229.
 agassizi, 312.
 argutum, 322.
 bilabiatum, 221.
 booneae, 229.
 chordatum, 239.
 elongatum, 322.
 erectum, 233.
 incultum, 332.
 latum, 384.
 limbiferum, 306.
 perplicatum, 321.
Chondropoma ternatum, 305.
 textum, 228.
Chondropomatus, 282, 383.
Chondropominae, 131, 132, 383.
chordata, *Parachondria*, 231, 237, 238, 239.
chordatum, *Adamsiella*, 239.
chordatum, *Chondropoma*, 239.
chordatum, *Cyclostoma*, 239.
chorrerensis, *Annularia*, 291, 292.
chorrillensis, *Annularia*, 361.
chorrillensis, *Tudora*, 268.
Cistula agassizii, 312.
 agrestis, 337.
 alatum, 373.
 bilabiata, 221.
 candeana, 331.
 candeanum, 331.
 catenata, 306.
 illustris, 331.
 inculta, 331.
 interstitiale, 367, 375, 377.
 interstitialis, 382.
 jimenoi, 311.
 limbifera, 306, 307.
 mackinlayi, 353.
 procax, 243.
clathratum, *Ctenopoma*, 161.
clathratum, *Cyclostoma*, 161.
clathratum, *Rhytidopoma*, 150, 159, 160, 161.
claudens, *Opisthosiphon*, 198, 201.
Colobostylus, 134, 135.
 arquesi, 372.
 heynemanni, 371.
 rangelinus, 280.
 rectus, 271.
 roemerii, 368.
colombense, *Rhytidopoma*, 158, 159.
columbense, *Opisthosiphon*, 195, 196.
complanata, *Tudora*, 251, 255.
coronadoi, *Annularia*, 295, 296.
coronadoi, *Cyclostoma*, 296.
coronatum, *Ctenopoma*, 151.
coronatum, *Cyclostoma*, 151.
coronatum, *Rhytidopoma*, 149, 151.
cortinae, *Annularia*, 291.
crassilabris, *Annularia*, 324, 325.
crassiuscula, *Tudora*, 266, 268.
cristata, *Tudora*, 266, 267, 268.
Ctenopoma argutum, 322.
 bilabiatum, 221.
 bufo, 261.
 clathratum, 161.
 coronatum, 151.
 deficiens, 144.
 echinatum, 165.
 enode, 276.
 honestum, 151.
 immersum, 146.
 jeannereti, 343.
 nigriculum, 239.
 nobilitatum, 259.
 nodiferum, 151.
 perspectivum, 264.
 pulverulentum, 254.

- Ctenopoma rotundatum*, 252.
 rugulosum, 153, 154, 155.
 sculptum, 167.
 semicoronatum, 278.
 torquata, 249.
 torreianum, 143.
 tryoni, 301.
 undosum, 254.
 wrightianum, 157.
Cubadamsiella, 240.
Cubitasiphona, 163, 198, 201.
cucullatum, *Opisthosiphon*, 168, 169, 170.
cumbrensis, *Annularia*, 299, 300, 324.
cumulata, *Annularia*, 366.
cumulata, *Tudora*, 369.
cunaguæ, *Opisthosiphon*, 199, 205.
Cyclostoma abnatum, 229.
 agassizii, 312.
 aguilerianum, 189.
 alatum, 350.
 arangianum, 333.
 architectonicum, 317.
 arquesi, 372.
 auricomum, 348.
 bilabiata, 221.
 bufo, 261.
 candeanum, 331.
 chordatum, 239.
 clathratum, 161.
 coronadoi, 296.
 coronatum, 151.
 daudinoti, 236.
 decoloratum, 265.
 denegatum, 161.
 disjunctum, 196.
 dorbignyanum, 221.
 eburneum, 345.
 echinatum, 165.
 echinus, 339.
 enode, 276.
 erectum, 233.
 excurrens, 139.
 fragile, 365.
 garridoianum, 280.
 heyneimanni, 371.
 honestum, 151.
 illustre, 331.
 immersum, 146.
 incultum, 331.
 interruptum, 305.
 interstitiale, 377.
 jimenoi, 311.
 latum, 383, 384.
 limbiferum, 306.
 lurida, 234.
 luridum, 234.
 mackinlayi, 353.
 mactum, 325.
 majusculum, 325.
 megacheilos, 248.
 minium, 336.
 moreletiana, 196.
 nigriculatum, 239.
 nobilitatum, 259.
 nodulatum, 153.
Cyclostoma perplicatum, 320.
 perspectivum, 264.
 pretrei, 341.
 procax, 243.
 pterostomum, 225.
 pulverulentum, 254.
 pupoides, 194.
 rangelinum, 280.
 rotundatum, 252.
 rugulosum, 155.
 salebrosum, 221.
 sculptum, 167.
 semicanum, 294.
 semicoronatum, 278.
 sordidum, 296, 297.
 textum, 228.
 torquata, 249.
 tractum, 327.
 troscheli, 257.
 undosum, 254.
 vannostrandii, 293.
 yaterasense, 370.
 yunqueense, 379.
Cyclostomus heyneimanni, 371.
 rectus, 271.
 römeri, 368, 372, 373.
Cylindrosiphona, 163, 215.
 dalli, *Dallsiphona*, 216.
 dalli, *Opisthosiphon*, 216.
 Dallsiphona, 133, 216.
 dalli, 216.
 daudinoti, *Choanopoma*, 236.
 daudinoti, *Cyclostoma*, 236.
 daudinoti, *Parachondria*, 231, 236.
 decolorata, *Choanopoma*, 265.
 decolorata, *Tudora*, 265.
 decoloratum, *Cyclostoma*, 265.
 deficiens, *Ctenopoma*, 144.
 deficiens, *Torrella*, 143, 144.
 degeneratum, *Opisthosiphon*, 183.
 delicatulum, *Xenopomoides*, 217.
 denegatum, *Cyclostoma*, 161.
 detectum, *Opisthosiphon*, 168, 190, 191.
 detectum, *Opisthosiphon*, 191.
 deviatum, *Opisthosiphon*, 199, 213.
 Diplopoma, 282, 314.
 architectonicum, 317, 318.
 torrei, 315.
 disjunctum, *Cyclostoma*, 196.
 distincta, *Annularia*, 307, 308.
 dorbignyanum, *Cyclostoma*, 221.
 eburnea, *Annularia*, 345.
 eburneum, *Choanopoma*, 345.
 eburneum, *Cyclostoma*, 345.
 echinatum, *Ctenopoma*, 165.
 echinatum, *Cyclostoma*, 165.
 echinatum, *Opisthosiphon*, 163, 165.
 echinus, *Annularia*, 338, 339.
 echinus, *Blaesospira*, 338, 339.
 echinus, *Choanopoma*, 339.
 echinus, *Cyclostoma*, 339.
 elongatum, *Chondropoma*, 322.
 enode, *Ctenopoma*, 276.
 enode, *Cyclostoma*, 276.

- enode, Tudora, 275, 276.
 erecta, Parachondria, 231, 232, 233, 236.
 erectum, Chondropoma, 233.
 erectum, Cyclostoma, 233.
 ergastulum, Rhytidopoma, 158, 159.
 escalerense, Opisthosiphon, 214.
 euglypta, Annularia, 356, 359.
 eurystoma, Annularia, 360, 361.
 Eutudora, 281, 303.
 agassizii, 312.
 jimenoi, 311.
 limbifera, 306.
 paradoxum, 136.
 torquata, 249.
 Eutudorella, 310.
 Eutudorex, 248, 250, 255.
 Eutudorisca, 282, 310.
 Eutudorops, 248.
 evanidum, Opisthosiphon, 168, 182, 183.
 excelsa, Annularia, 324, 326.
 excurrens, Cyclostoma, 139.
 excurrens, Opisthocoeleum, 138, 139.
 excurrens, Opisthosiphon, 139.
 excurrens, Tudora, 139.

 fallax, Annularia, 330, 331.
 fascia, Parachondria, 227.
 Fossularia, 282, 308.
 fragile, Choanopoma, 365.
 fragile, Cyclostoma, 365.
 fragilis, Annularia, 364, 365, 366.

 garciai, Opisthosiphon, 215, 216.
 garciana, Limadora, 245, 246, 247.
 garciana, Ramsdenia, 247.
 garridoiana, Tudora, 275, 279, 280.
 garridoianum, Cyclostoma, 280.
 gibbosum, Opisthocoeleum, 135, 136.
 gratiosa, Adamsiella, 240.
 greenfieldi, Opisthosiphon, 168, 171.
 grillensis, Torrella, 146, 147.
 guaicanamarensis, Tudora, 273, 274.
 guajabanense, Opisthosiphon, 187.
 Guajaibona, 282, 341.
 guanajaense, Opisthosiphon, 198, 202.
 guantanamensis, Parachondria, 237, 238.
 guayosense, Opisthosiphon, 178, 180.
 guitarti, Annularia, 288, 289.
 gundlachi, Tudora, 275, 277.
 Gundlachtudora, 248, 265.

 hendersoni, Annularia, 366, 367.
 hendersoni, Xenopoma, 225, 226, 227.
 hespericum, Rhytidopoma, 150, 161.
 heynemani, Tudora, 371.
 heynemanni, Annularia, 366, 371.
 heynemanni, Colobostylus, 371.
 heynemanni, Cyclostoma, 371.
 heynemanni, Cyclostomus, 371.
 heynemanni, Tudora, 371.
 holguinense, Opisthosiphon, 189, 190.
 holguinensis, Annularia, 366, 373.
 honestum, Ctenopoma, 151.
 honestum, Cyclostoma, 151.
 honestum, Rhytidopoma, 149, 150, 151.
 humboldtiana, Xenopoma, 223.
 humboldtianum, Choanopoma, 223.
 humboldtianum, Xenopoma, 223.
 hystrix, Choanopoma, 225.
 hystrix, Xenopoma, 223, 225, 227.

 illustre, Cyclostoma, 331.
 illustris, Annularia, 330, 331.
 illustris, Cistula, 331.
 illustris, Troschelvinde, 331.
 immersa, Torrella, 143, 145, 146.
 immersum, Ctenopoma, 146.
 immersum, Cyclostoma, 146.
 incerta, Annularia, 352, 354.
 inculta, Annularia, 327, 331, 332.
 inculta, Cistula, 331.
 incultum, Chondropoma, 332.
 incultum, Cyclostoma, 331.
 indioensis, Annularia, 285.
 indivisa, Annularia, 283, 286.
 indivisum, Choanopoma, 286.
 infernalis, Annularia, 339, 340.
 inquisita, Annularia, 309.
 inquisita, Choanopoma, 309.
 insulanum, Opisthosiphon, 168, 180, 181.
 insularia, Annularia, 322.
 intereisa, Annularia, 352.
 interruptum, Cyclostoma, 305.
 interstitiale, Cistula, 367, 375, 377.
 interstitiale, Cyclostoma, 377.
 interstitialis, Annularia, 366, 377.
 interstitialis, Cistula, 382.
 interstitialis, Tudora, 377.
 itinerans, Rhytidopoma, 150.

 jeannereti, Annularia, 342, 343.
 jeannereti, Ctenopoma, 343.
 jeannereti, Parachondria, 343.
 jiganense, Choanopoma, 329.
 jiganensis, Annularia, 327, 328, 329.
 jimenoi, Annularia, 310, 311.
 jimenoi, Cistula, 311.
 jimenoi, Cyclostoma, 311.
 jimenoi, Eutudora, 311.
 Juannularia, 282, 320.
 judacensis, Opisthosiphon, 206.
 judasense, Opisthosiphon, 199, 206.
 juliani, Annularia, 365.
 jumaguaense, Rhytidopoma, 160.

 lachneri, Annularia, 342.
 lachneri, Choanopoma, 342.
 lamellicostatum, Opisthocoeleum, 140, 141, 142.
 lamellicostatum, Opisthosiphon, 142.
 lamellosum, Opisthosiphon, 168, 172, 173.
 lata, Annularia, 383, 384.
 latistoma, Annularia, 304, 308.
 latum, Chondropoma, 384.
 latum, Cyclostoma, 383, 384.
 laureani, Tudora, 253.
 leoni, Adamsiella, 241, 242.
 libanoensis, Annularia, 317, 318, 366, 376.
 Limadora, 132, 244, 245.
 garciana, 245, 246, 247.
 scabrata, 245, 247.
 sillaensis, 246, 247.
 tollini, 245.

- Limadorex*, 132, 244.
limonensis, 244.
limbifera, *Annularia*, 303, 304, 305, 306, 308.
limbifera, *Cistula*, 306, 307.
limbifera, *Eutudora*, 306.
limbiferum, *Chondropoma*, 306.
limbiferum, *Cyclostoma*, 306.
limonensis, *Limadorex*, 244.
lincina, *Turbo*, 281.
lirata, *Annularia*, 360, 363, 364.
litorale, *Opisthosiphon*, 199, 208.
lowei, *Opisthosiphon*, 172, 173.
lucasense, *Opisthosiphon*, 191.
lucifer, *Annularia*, 339, 340.
Lugarenia, 282, 360.
lurida, *Cyclostoma*, 234.
lurida, *Parachondria*, 231, 234, 236.
lurida, *Tudora*, 234.
luridum, *Cyclostoma*, 234.

mabuyense, *Opisthocoeleum*, 142.
mackinlayi, *Annularia*, 352, 353.
mackinlayi, *Cistula*, 353.
mackinlayi, *Cyclostoma*, 353.
mackinlayi, *Tudora*, 353.
macta, *Annularia*, 324, 325.
mactum, *Cyclostoma*, 325.
magistra, *Annularia*, 333, 334.
magnum, *Opisthocoeleum*, 135, 136.
majuscula, *Annularia*, 323, 324, 325, 326.
majusculum, *Choanopoma*, 325.
majusculum, *Cyclostoma*, 325.
manatiense, *Opisthosiphon*, 198, 203.
martiensis, *Tudora*, 270, 271.
mayariensis, *Annularia*, 381, 382.
mayariensis, *Parachondria*, 237, 238.
mayariensis, *Tudora*, 259, 261.
mayensis, *Annularia*, 367, 379.
mayensis, *Parachondria*, 233.
mayensis, *Tudora*, 379.
magacheilos, *Cyclostoma*, 248.
mimetica, *Annularia*, 383, 385.
minaensis, *Annularia*, 297, 298.
minia, *Annularia*, 327, 336.
minium, *Annularia*, 336.
minium, *Choanopoma*, 336.
minium, *Cyclostoma*, 336.
mirandensis, *Tudora*, 259, 260.
mirifica, *Choanopoma*, 260.
mirifica, *Ramsdenia*, 260.
mirifica, *Tudora*, 258, 259, 260.
Mirisiphon, 163, 167.
moreletiana, *Cyclostoma*, 196.
moreletiana, *Opisthosiphon*, 196.
moreletiana, *Tudora*, 196.
moreletianum, *Opisthosiphon*, 193, 195, 196.
morenoi, *Annularia*, 302, 302.
morsei, *Annularia*, 297, 298.
murinum, *Opisthosiphon*, 190, 191.

najazaensis, *Annularia*, 360, 362, 363.
najazaensis, *Tudora*, 273, 274.
nana, *Annularia*, 294, 295.
nana, *Rhytidothyra*, 220, 222.
narcisi, *Annularia*, 324, 325.
natensoni, *Annularia*, 291, 292, 366, 377.

natensoni, *Tudora*, 258, 263.
negrosensis, *Annularia*, 328, 329.
nigricula, *Parachondria*, 231, 239.
nigriculum, *Cyclostoma*, 239.
nipensis, *Annularia*, 344, 345, 366, 375.
nobilitata, *Tudora*, 258, 259, 260.
nobilitatum, *Ctenopoma*, 259.
nobilitatum, *Cyclostoma*, 259.
nobilitatum, *Ramsdenia*, 259.
nodiferum, *Ctenopoma*, 151.
nodiferum, *Rhytidopoma*, 150, 151.
nodulatum, *Cyclostoma*, 153.
nodulatum, *Rhytidopoma*, 149, 152, 153.
notata, *Tudora*, 258, 262.

obesa, *Tudora*, 266, 275.
obliterata, *Annularia*, 356, 358.
obsoleta, *Annularia*, 283, 287, 315, 320.
obtectum, *Opisthosiphon*, 168, 178, 179, 180.
obtectus, *Opisthosiphon*, 179.
obturatum, *Opisthosiphon*, 168, 176, 177.
obturatus, *Opisthosiphon*, 177.
occidentale, *Rhytidopoma*, 150, 154.
occultum, *Opisthocoeleum*, 138, 140.
occultum, *Opisthosiphon*, 138.
occultus, *Opisthosiphon*, 138.
opisthocoele, *Opisthocoeleum*, 134, 140.
Opisthocoelex, 134, 138.
Opisthocoeleum, 133, 134, 140, 289.
excurrens, 138, 139.
gibbosum, 135, 136.
lamelliscostatum, 140, 141, 142.
mabuyense, 142.
magnum, 135, 136.
occultum, 138, 140.
opisthocoele, 134, 140.
paradoxum, 134, 135, 136.
simulans, 135, 137.
Opisthocoelops, 134, 138.
Opisthosiphon, 133, 134, 162, 218.
aguilerianum, 168, 189.
andrewsi, 168, 192.
apertum, 199, 212.
apertus, 212.
bacillum, 215, 216.
bahamense, 162.
bananaense, 168, 175, 176.
bermudezi, 168, 192.
berryi, 199, 209, 210.
bibijaguaense, 194, 195.
bioscali, 198, 204.
caguanense, 168, 185.
camajanense, 170, 171.
caroli, 163, 166.
casasense, 194.
claudens, 198, 201.
columbense, 195, 196.
cucullatum, 168, 169, 170.
cunaguae, 199, 205.
dalli, 216.
degeneratum, 183.
detectum, 168, 190, 191.
detectus, 191.
deviatum, 199, 213.
echinatum, 163, 165.

Opisthosiphon escalarense, 214.
evanidum, 168, 182, 183.
excurrens, 139.
garciai, 215, 216.
greenfieldi, 168, 171.
guajabanense, 187, 188.
guanajaense, 198, 202.
guayosense, 178, 180.
holguinense, 189, 190.
insulanum, 168, 180, 181.
judacensis, 206.
judasense, 199, 206.
lamellicostatum, 142.
lamellosum, 168, 172, 173.
litorale, 199, 208.
lowei, 172, 173.
lucasense, 191.
manatiense, 198, 203.
moreletiana, 196.
moreletianum, 193, 195, 196.
murinum, 190, 191.
obtectum, 168, 178, 179, 180.
obtectus, 179.
obturatum, 168, 176, 177.
obturatus, 177.
occultum, 138.
occultus, 138.
palmeri, 168, 170, 171.
paredonense, 199, 213, 214.
paredonensis, 214.
plateroense, 168, 173.
plicatum, 193, 196, 197.
poeyi, 198, 199.
prominulum, 168, 174.
protractum, 198, 200.
protractus, 200.
puntillense, 187.
pupoides, 193, 194.
quesadai, 163, 164.
quintanense, 187, 188.
quinti, 198, 202.
rivorum, 166.
sainzi, 163.
salustii, 168, 181.
sanchezi, 199, 207.
scopulorum, 180, 181.
sculptum, 167.
seibaboense, 178, 179.
semiapertum, 210.
semiapertus, 210.
sosai, 199, 208.
subobtectum, 168, 186, 187.
subobturatum, 168, 183, 184.
subobturatus, 184.
sulcosum, 177.
tenuicostum, 178, 179.
tersum, 199, 211.
tinajaense, 184.
torrei, 168, 185.
transitorium, 210, 211.
trincheracensis, 176.
trincherasense, 175, 176.
turiguanoense, 193, 197.
velazquezi, 194.
viguetense, 210.
Opisthosiphona, 163, 193.
organicola, *Annularia*, 294, 295.
ottonis, *Rhytidopoma*, 156, 157.

palenquense, *Rhytidopoma*, 153, 154.
pellens, *Annularia*, 345, 350.
palmaritensis, *Tudora*, 257, 258.
palmeri, *Opisthosiphon*, 168, 170, 171.
palomarensis, *Annularia*, 362, 363.
Parachondria, 134, 137, 227, 228, 235.
abnata, 227, 229, 231, 235.
abtiana, 231, 235.
baracoensis, 237, 238.
booneae, 228, 229.
campbelli, 231.
chordata, 231, 237, 238, 239.
daudinoti, 231, 236.
erecta, 231, 232, 233, 236.
fascia, 227.
guantanamensis, 237, 238.
jeannereti, 343.
lurida, 231, 234, 236.
mayariensis, 237, 238.
mayensis, 233.
nigricula, 231, 239.
portillensis, 228, 229.
ramonensis, 233.
songoensis, 237, 238, 239.
tanamensis, 237, 238.
texa, 227, 228.
turquinensis, 233, 234.
wrighti, 231.
Parachondrops, 227, 231, 232.
paradoxum, *Eutudora*, 136.
paradoxum, *Opisthocelicum*, 134, 135, 136.
paredonense, *Opisthosiphon*, 199, 213, 214.
paredonensis, *Opisthosiphon*, 214.
parva, *Annularia*, 363, 364.
payroli, *Annularia*, 356, 357.
perezi, *Annularia*, 283, 288, 289.
perplexa, *Annularia*, 291, 302.
perplicata, *Annularia*, 320, 321.
perplicatum, *Choanopoma*, 321.
perplicatum, *Chondropoma*, 321.
perplicatum, *Cyclostoma*, 320.
perspectiva, *Tudora*, 258, 264.
perspectivum, *Ctenopoma*, 264.
perspectivum, *Cyclostoma*, 264.
perspectivum, *Ramsdenia*, 264.
perspectivum, *Rhytidopoma*, 264.
pilsbryi, *Annularia*, 289, 315, 318.
pilsbryi, *Choanopoma*, 289.
pinense, *Rhytidopoma*, 150, 157, 158, 159.
plateroense, *Opisthosiphon*, 168, 173.
plicata, *Annularia*, 291, 298.
plicatum, *Opisthosiphon*, 193, 196, 197.
poeyi, *Opisthosiphon*, 198, 199.
portillensis, *Parachondria*, 228, 229.
prestoni, *Annularia*, 345, 346.
pretrei, *Annularia*, 341.
pretrei, *Blaesospira*, 341.
pretrei, *Choanopoma*, 341.
pretrei, *Cyclostoma*, 341.
procax, *Adamsiella*, 241, 243.
procax, *Cistula*, 243.
procax, *Cyclostoma*, 243.
prominulum, *Opisthosiphon*, 168, 174.
protractum, *Opisthosiphon*, 198, 200.
protractus, *Opisthosiphon*, 200.
pseudalata, *Annularia*, 366, 373.

- pseudalatum*, Annularia, 373.
pseudolatum, Annularia, 373.
pterostomum, Cyclostoma, 225.
pulverulenta, Tudora, 251, 254.
pulverulentum, Ctenopoma, 254.
pulverulentum, Cyclostoma, 254.
puntillense, Opisthosiphon, 187, 188.
pupoides, Cyclostoma, 194.
pupoides, Opisthosiphon, 193, 194.
pupoides, Tudora, 194.
putre, Annularia, 348, 349.
putre, Choanopoma, 349.
putre, Tudora, 349.

quesadai, Opisthosiphon, 163, 164.
quintanense, Opisthosiphon, 187, 188.
quinti, Opisthosiphon, 198, 202.

ramonensis, Parachondria, 233.
ramsdeni, Tudora, 355.
Ramsdenia, 248, 258, 262.
 bufo, 261.
 garciana, 247.
 mirifica, 260.
 nobilitatum, 259.
 perspectivum, 264.
 semicoronata, 278.
 tollini, 245.
ramsdenia, Annularia, 315, 316, 352, 355.
rangelina, Tudora, 280.
rangelinum, Cyclostoma, 280.
rangelinus, Colobostylus, 280.
recta, Tudora, 266, 270, 271.
rectus, Colobostylus, 271.
rectus, Cyclostomus, 271.
Rhytidopoma, 133, 149.
 anafense, 153, 154.
 cabrasense, 156, 157.
 candelaense, 160, 161.
 clathratum, 150, 159, 160, 161.
 colombense, 158, 159.
 coronatum, 149, 151.
 ergastulum, 158, 159.
 hespericum, 150, 161.
 honestum, 149, 150, 151.
 itinerans, 150.
 jumaguaense, 160.
 nodiferum, 150, 151.
 nodulatum, 149, 152, 153.
 occidentale, 150, 154.
 ottonis, 156, 157.
 palenquense, 153, 154.
 perspectivum, 264.
 pinense, 150, 157, 158, 159.
 rosarioense, 158.
 rugulosum, 149, 150, 155.
 tollini, 245.
 wrightianum, 150, 156, 157.
Rhytidopominae, 131, 132, 133.
Rhytidothyra, 134, 218.
 aurantiaca, 220, 221.
 bilabiata, 218, 220, 221.
 nana, 220, 222.
 rosacea, 220.
 rosea, 220.
 straminea, 220, 222.
rivorum, Opisthosiphon, 166.

rocai, Annularia, 327, 336, 338, 340.
rocai, Tudora, 251, 255.
roemerii, Colobostylus, 368.
roemerii, Tudora, 368.
römeri, Annularia, 366, 368.
römeri, Cyclostomus, 368, 372, 373.
rosacea, Rhytidothyra, 220.
rosarioense, Rhytidopoma, 158.
rosea, Rhytidothyra, 220.
rotundata, Tudora, 250, 252.
rotundatum, Ctenopoma, 252.
rotundatum, Cyclostoma, 252.
rugulosum, Ctenopoma, 153, 154, 155.
rugulosum, Cyclostoma, 155.
rugulosum, Rhytidopoma, 149, 150, 155.

sainzi, Opisthosiphon, 163.
salebrosum, Cyclostoma, 221.
salustii, Opisthosiphon, 168, 181.
sanchezi, Opisthosiphon, 199, 207.
sauvallei, Annularia, 290, 291, 292.
sauvallei, Choanopoma, 292.
scabrata, Limadora, 245, 247.
scopulorum, Opisthosiphon, 180, 181.
sculptum, Ctenopoma, 167.
sculptum, Cyclostoma, 167.
sculptum, Opisthosiphon, 167.
seibaboense, Opisthosiphon, 178, 179.
semiapertum, Opisthosiphon, 210.
semiapertus, Opisthosiphon, 210.
semicana, Annularia, 290, 293, 294, 295, 300.
semicanum, Cyclostoma, 294.
semicoronata, Ramsdenia, 278.
semicoronata, Tudora, 275, 278.
semicoronatum, Ctenopoma, 278.
semicoronatum, Cyclostoma, 278.
sibanicuensis, Tudora, 269, 270.
sifontesi, Annularia, 360, 364.
sillaensis, Limadora, 246, 247.
simpsoni, Torrella, 147, 148.
simulans, Opisthocoeleum, 135, 137.
Solutapex, 163.
songoensis, Annularia, 315, 319.
songoensis, Parachondria, 237, 238, 239.
sordidum, Annularia, 297.
sordidum, Cyclostoma, 296, 297.
sosai, Opisthosiphon, 199, 208.
spinossissimum, Xenopoma, 223, 226.
spurca, Annularia, 296, 297.
storchi, Annularia, 342, 344.
storchi, Choanopoma, 344.
straminea, Rhytidothyra, 220, 222.
suavis, Tudora, 266, 267.
Subannularia, 282, 342.
subobtectum, Opisthosiphon, 168, 186, 187.
subobturatum, Opisthosiphon, 168, 183, 184.
subobturatus, Opisthosiphon, 184.
sulcosum, Opisthosiphon, 177.

tacrensis, Annularia, 345, 351.
tanamensis, Annularia, 317, 318, 366, 375.
tanamensis, Parachondria, 237, 238.
tenuicostum, Opisthosiphon, 178, 179.
ternata, Annularia, 305, 306.

- ternatum, *Chondropoma*, 305.
 terneroensis, *Annularia*, 283, 284, 285, 287.
 terneroensis, *Torrella*, 148.
 tersum, *Opisthosiphon*, 199, 211.
 texta, *Parachondria*, 227, 228.
 textum, *Chondropoma*, 228.
 textum, *Cyclostoma*, 228.
 tinajaense, *Opisthosiphon*, 184.
 tollini, *Limadora*, 245.
 tollini, *Ramsdenia*, 245.
 tollini, *Rhytidopoma*, 245.
 toroensis, *Annularia*, 367, 378.
 torquata, *Ctenopoma*, 249.
 torquata, *Cyclostoma*, 249.
 torquata, *Eutudora*, 249.
 torquata, *Tudora*, 249.
 torrei, *Annularia*, 315.
 torrei, *Diplopoma*, 315.
 torrei, *Opisthosiphon*, 168, 185.
 torrelana, *Torrella*, 143.
 torreianum, *Ctenopoma*, 143.
Torrella, 133, 143.
 camaronensis, 146, 147.
 deficiens, 143, 144.
 grillensis, 146, 147.
 immersa, 143, 145, 146.
 simpsoni, 147, 148.
 terneroensis, 149.
 torrelana, 143.
 trinidadensis, 147.
Torrellisca, 143, 147.
 tracta, *Annularia*, 327.
 tractum, *Choanopoma*, 327.
 tractum, *Cyclostoma*, 327.
 transitoria, *Annularia*, 304, 306, 307, 308.
 transitorium, *Opisthosiphon*, 210, 211.
 trincherasensis, *Opisthosiphon*, 176.
 trincherasense, *Opisthosiphon*, 175.
 trinidadensis, *Torrella*, 147.
 troscheli, *Choanopoma*, 257.
 troscheli, *Cyclostoma*, 257.
 troscheli, *Tudora*, 251, 256, 257.
 Troschelvindex, 282, 326.
 candeanum, 331.
 illustris, 331.
 tryoni, *Annularia*, 291, 300.
 tryoni, *Choanopoma*, 301.
 tryoni, *Ctenopoma*, 301.
 tuberculata, *Tudora*, 266, 272.
Tudora, 244, 248, 249, 280.
 abtiana, 235.
 aguayoi, 266, 273.
 aguilleriana, 189.
 alatum, 351.
 antoniensis, 257.
 arcticoronata, 275, 276.
 asperata, 266, 272.
 auricoma, 348.
 azucarensis, 257.
 baracoensis, 279.
 barreti, 270, 271.
 barroi, 253.
 bermudezi, 266, 269, 270.
 bufo, 258, 261.
 canetensis, 263, 264.
 Tudora—chorrillensis, 268.
 complanata, 251, 255.
 crassiuscula, 266, 268.
 cristata, 266, 267, 268.
 decolorata, 265.
 enode, 275, 276.
 excurrens, 139.
 garridoiana, 275, 279, 280.
 guaicanamarensis, 273, 274.
 gundlachi, 275, 277.
 heynemanni, 371.
 interstitialis, 377.
 laureani, 253.
 lurida, 234.
 mackinlayi, 353.
 martiensis, 270, 271.
 mayariensis, 259, 261.
 mayensis, 379.
 mirandensis, 259, 260.
 mirifica, 258, 259, 260.
 moreletiana, 196.
 najazaensis, 273, 274.
 natensoni, 258, 263.
 nobilitata, 258, 259, 260.
 notata, 258, 262.
 obesa, 266, 275.
 palmaritensis, 257, 258.
 perspectiva, 258, 264.
 pulverulenta, 251, 254.
 pupoides, 194.
 putre, 349.
 ramsdeni, 355.
 rangelina, 280.
 recta, 266, 270, 271.
 rocai, 251, 255.
 roemeri, 368.
 rotundata, 250, 252.
 semicoronata, 275, 278.
 sibanicuensis, 269, 270.
 suavis, 266, 267.
 torquata, 249.
 troscheli, 251, 257.
 tuberculata, 266, 272.
 undosa, 251, 252, 253, 254.
 varicosa, 266, 274.
 welchi, 250, 251.
 wrighti, 231.
 yateracensis, 370.
 yaterasensis, 259, 261.
Tudorellata, 366.
Tudorina, 248, 280.
Turbo lincina, 281.
 turiguanense, *Opisthosiphon*, 193, 197.
 turquinensis, *Parachondria*, 233, 234.

 uncinata, *Annularia*, 282, 283, 284.
 uncinatum, *Choanopoma*, 283.
 undosa, *Tudora*, 251, 252, 253, 254.
 undosum, *Ctenopoma*, 254.
 undosum, *Cyclostoma*, 254.

 vannostrandii, *Annularia*, 290, 293.
 vannostrandii, *Cyclostoma*, 293.
 varicosa, *Tudora*, 266, 274.
 velazquezi, *Opisthosiphon*, 194.
 victoris, *Annularia*, 366, 369.
 viguetense, *Opisthosiphon*, 210.

vinalensis, Annularia, 300, 301.

welchi, Annularia, 381.

welchi, Tudora, 250, 251.

wrighti, Annularia, 367, 380.

wrighti, Parachondria, 231.

wrighti, Tudora, 231.

wrightianum, Ctenopoma, 157.

wrightianum, Rhytidopoma, 150, 156,
157.

Wrightudora, 248, 275.

Xenopoma, 134, 218, 222, 224.

aguayoi, 223, 224.

hendersoni, 223, 225, 226, 227.

Xenopoma—humboldtiana, 223.

humboldtianum, 223.

hystrix, 223, 225, 227.

spinosissimum, 223, 226.

Xenopomoides, 134, 217.

delicatulum, 217.

yateracensis, Tudora, 370.

yaterasense, Choanopoma, 370.

yaterasense, Cyclostoma, 370.

yaterasensis, Annularia, 366, 370.

yaterasensis, Tudora, 259, 261.

yumuriensis, Annularia, 366, 374.

yunquense, Choanopoma, 379.

yunquense, Cyclostoma, 379.

yunquensis, Annularia, 366, 367, 379.



INDIAN AGRICULTURAL RESEARCH
INSTITUTE LIBRARY,
NEW DELHI.

[illegible]

MCHPC- 83-90 AR/57-20-2.58-4,000.